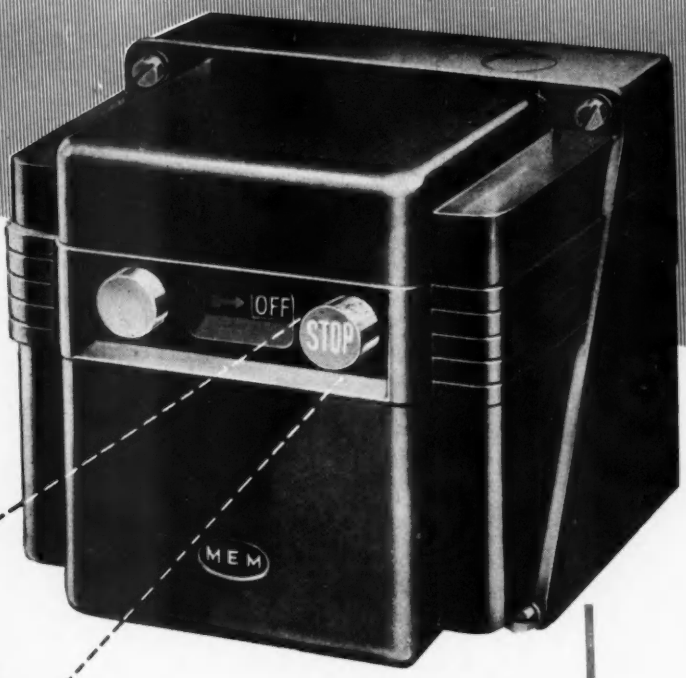
ELECTRICAL TIMES

THURSDAY
20 DEC.
1951
NINEPENCE



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Send for list No. 300 for full details

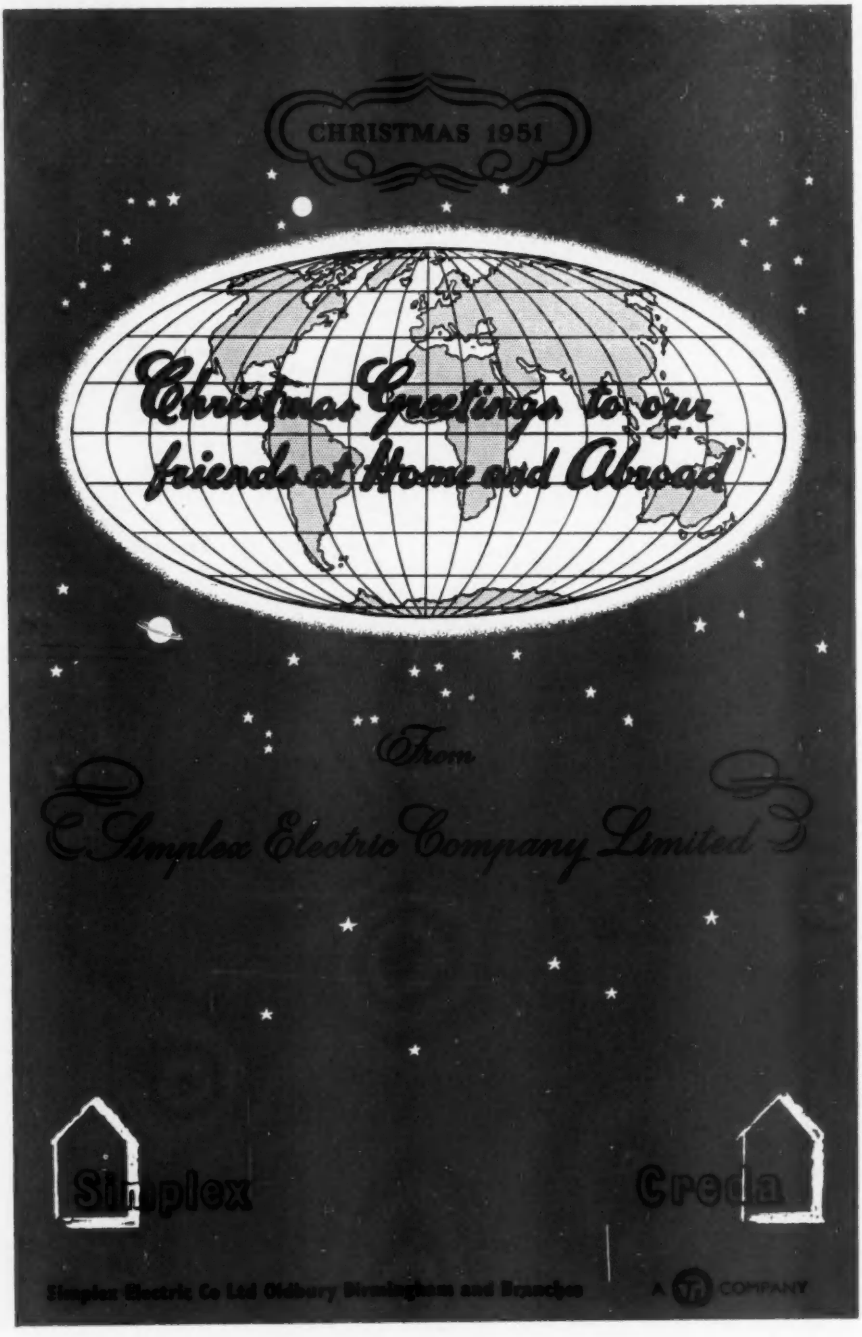
If you need proof of the advantages of specialisation you must examine the new Auto-Memota starters. They embody the results of more than 40 years of design specialisation, and are made in the most self-contained low tension switchgear factory in the world. When you see the advanced design and fine finish we think you will agree that they say the last word in motor starting and protective equipment.

MEM

Switch, fuse and motor control gear, electric fires and localised lighting equipment

MIDLAND ELECTRIC MANUFACTURING CO. LTD., BIRMINGHAM 11

Branches in London and Manchester


CHRISTMAS 1951
Christmas Greetings to our friends at Home and Abroad
From
Simplex Electric Company Limited
Simplex
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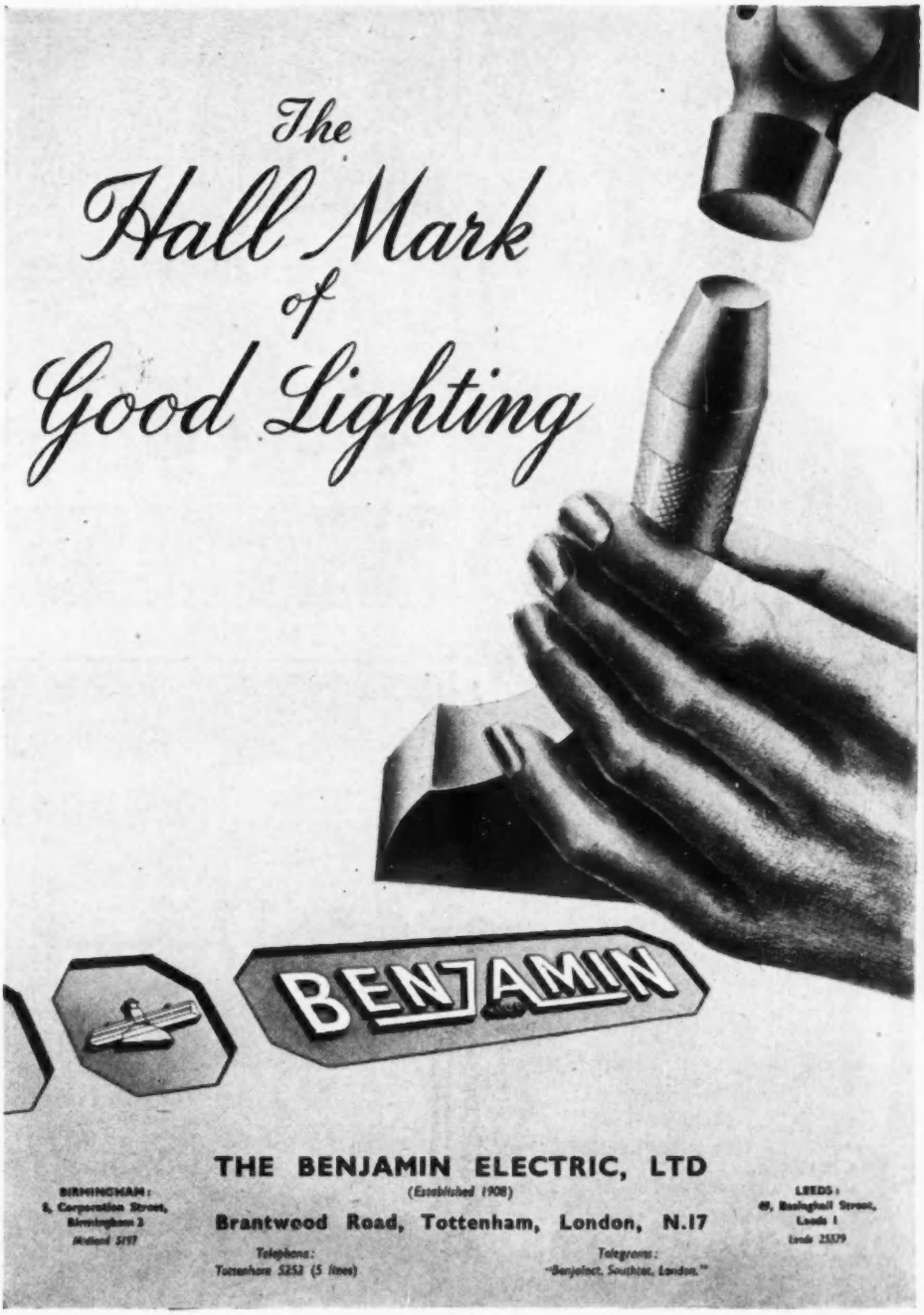
Simplex Electric Co Ltd Oldbury Birmingham and Branches
A TI COMPANY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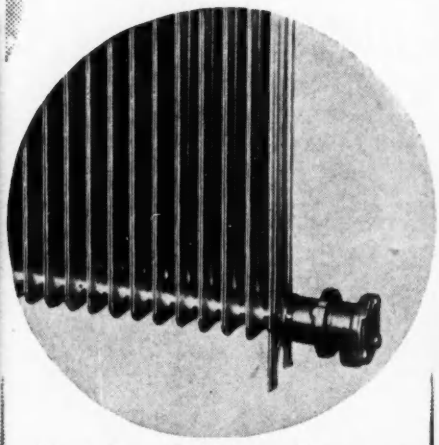
A

NO DANGER OF FIRE with "DUNLOW" Flame Proof ELECTRIC RADIATORS



Ideal for Cellulose Spraying Rooms, Petroleum Stores, Operating Theatres, etc.

FLP ← THIS IS YOUR SAFEGUARD

Where safety is the first consideration "Dunlow" Flameproof Heaters are essential. The heating unit in these radiators is similar to our water and oil

FLAMEPROOF IMMERSION HEATERS

Certified by Buxton

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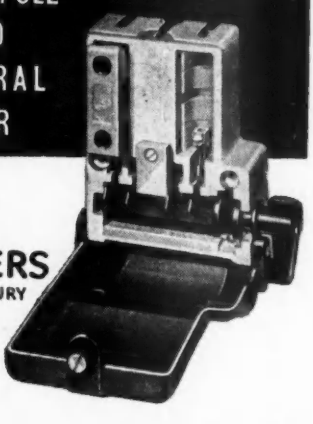
293 BELL STREET GLASGOW C4

SINGLE POLE AND NEUTRAL GEAR

by

SANDERS WEDNESBURY



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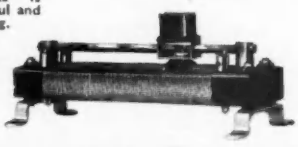
CRESSALL Resistances incorporate the soundest electrical and mechanical principles in design—yet prices are competitive.

CRESSALL Resistance

List No. 80 containing data and prices of our standard sliding Resistances is both useful and interesting. May we send you a copy?



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SMALLEST

Electrically Wound Time Switch

on the market

The Horstmann Gear Co. Ltd. are proud to introduce their latest small electrically wound time switch, type "Y." The main features of this remarkably compact unit are:

- ★ **Smallest electrically wound time switch on the market.**
- ★ **INCORPORATES 12-HOUR SPRING RESERVE.**
- ★ **11-jewelled escapement, horizontally positioned to give best possible timekeeping.**
- ★ **Intermediate tappets can be provided for Solar dials. For hand-set dials two or four tappets can be supplied, as required.**
- ★ **Movement enclosed in dustproof case: complete time switch can be provided with, or without, outer weatherproof metal case.**
- ★ **OUTSIDE DIMENSIONS OF WEATHERPROOF CASE, WIDTH 3¼ in., DEPTH 3 1/16 in., HEIGHT 6¼ in.**
- ★ **Manually operated circuit-tester.**
- ★ **Single-pole metal airbreak contacts, rated at either 10 or 20 amps at 250 volts A.C.**
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- ★ **Switch and clock movement may be removed from housing without disturbing wiring.**
- ★ **SPECIALLY DESIGNED FOR PUBLIC LIGHTING REQUIREMENTS BUT IS ALSO IDEAL FOR PEAK LOAD CONTROL OF WATER HEATERS, ETC.**

Orders can now be accepted and reasonable deliveries given.

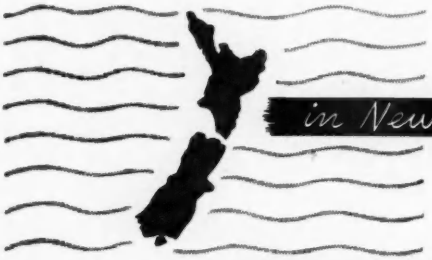
The **NEW**

TYPE Y

TIME SWITCH

The **HORSTMANN GEAR CO. LTD.**

NEWBRIDGE WORKS, BATH, ENGLAND. TEL: 7241



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In New Zealand, the earth's furnace supplies the famous Hot Springs.

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FB. (Storage type) AUTOMATIC ELECTRIC WATER HEATER

which embodies the latest principles in efficient and simple design.

The hot water storage provides a constant and dependable supply of hot water, and a thermostat ensures water temperature being raised to normal after each draw-off. Current is automatically cut off when the required temperature is reached.

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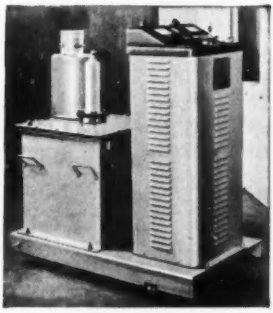
This is an electrical seashell

Diala Phasianella

The delicate, attractive Diala shells are found in the warm waters of the West Pacific. Diala Phasianella (pheasant Diala) has a semi-transparent shell, less than a quarter of an inch long. The smooth, whitish surface is elegantly decorated with chestnut-coloured markings in the form of minute spots and faint lines.

Shell Diala Oils are specially designed for electrical applications. They are recommended for transformers, oil-filled switchgear and capacitors, and for general insulating and dielectric purposes. Shell Diala Oil "B" complies with the British Standard Specification 148 1951.



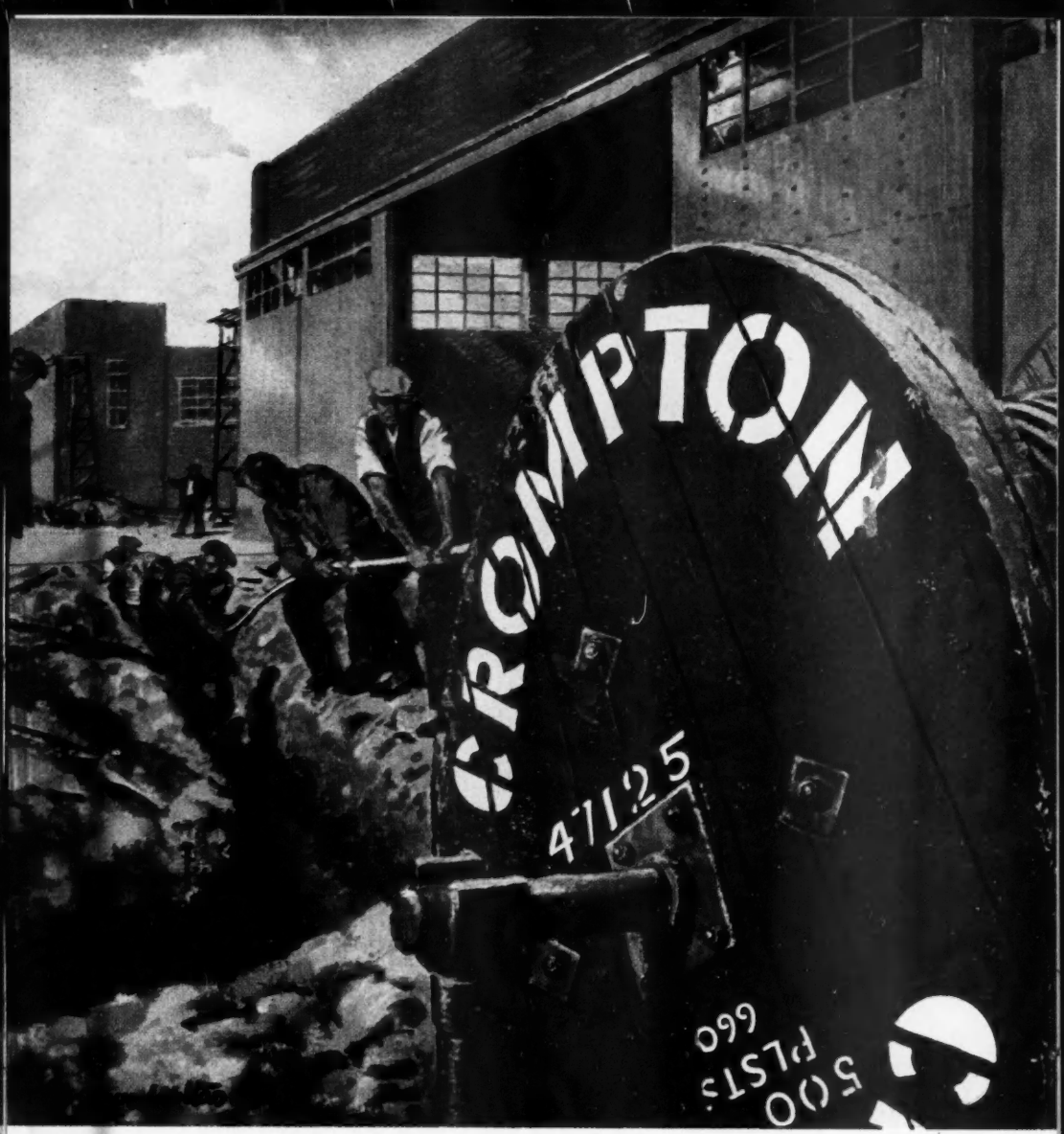
Seashell Oils are produced as the result of world-wide *research. This picture shows apparatus for determining breakdown voltage—one of the various tests carried out on electrical insulating oils prior to despatch.*

The Seashell range of specialised industrial lubricants, which includes Shell Diala Oils, is marketed throughout the world. There is a Seashell grade for *every* industrial use—and each of these grades is available everywhere in the same high quality. Shell lubrication engineers will be pleased to provide further information and to make specific recommendations for particular purposes.

Shell *Diala* Oil

SHELL

LEADERSHIP IN LUBRICATION



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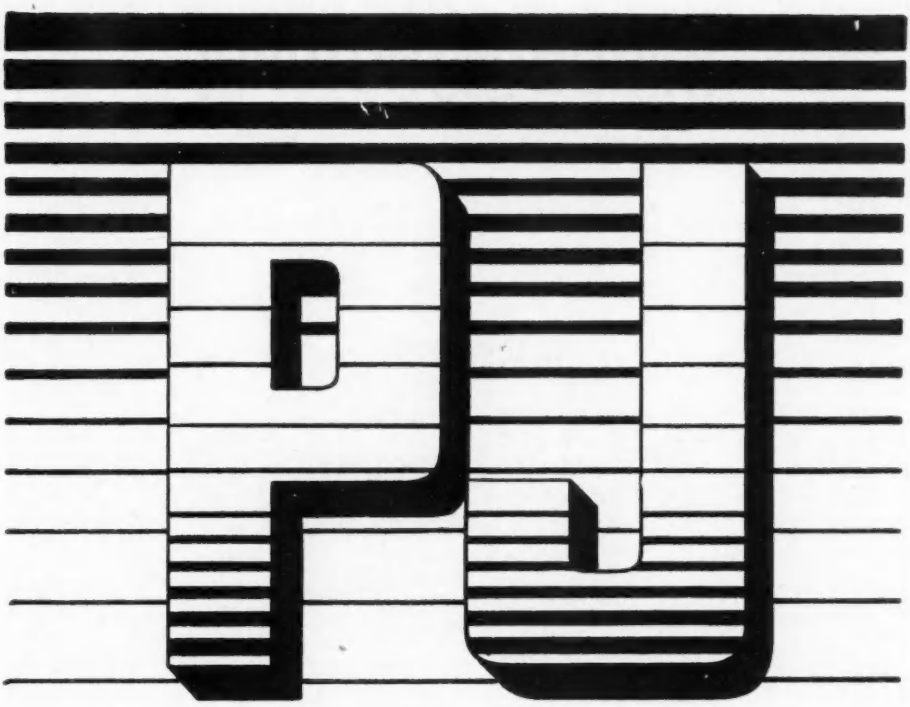

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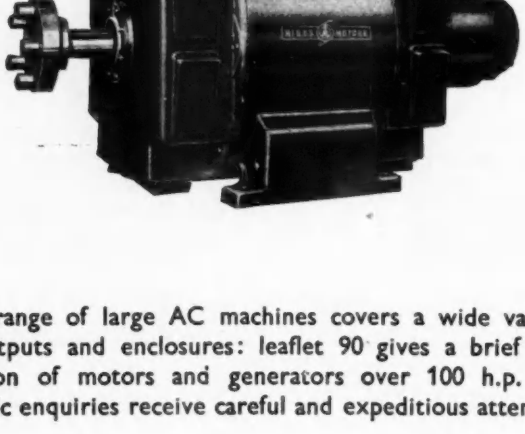
CHAIRMAN WALTER F HIGGS M.I.E.E.

BIRMINGHAM 6 ENGLAND



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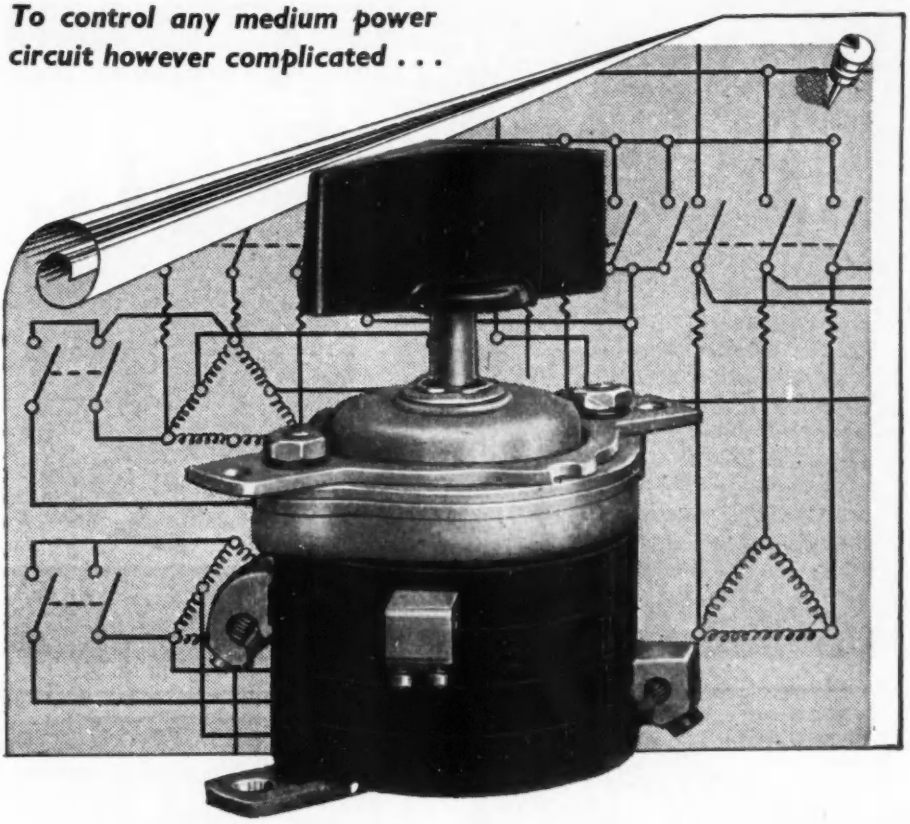

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SANTON ROTARY SWITCH!

SANTON switches operate on a simple rotary movement.

SANTON switches have large, easily accessible terminals, plainly marked.

SANTON switches are available from 10-60 Amps. (180 under special conditions), any number of poles up to six positions—up to 660 volts.

SANTON switches can be delivered promptly and give years of trouble-free service.

Most areas have a SANTON Resident Engineer who will be pleased to call and discuss your switching problems with you. Take the first step today towards simpler, more efficient control.

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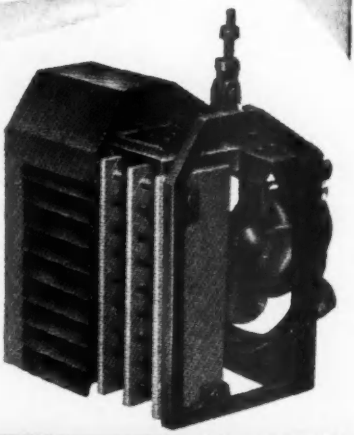

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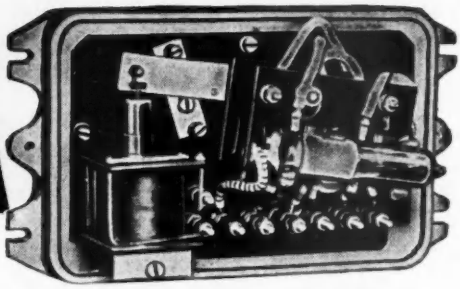

Of extremely compact design, substantially mounted and well protected, ISENTHAL Relays are available in a range of Tilting and Vertical Plunger types, and can be relied upon to give efficient and dependable performance.

We will gladly supply full details upon request and our technicians are at your disposal to advise upon your problems.

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ELECTRO-MAGNETIC RELAYS

for operating Mercury Switches up to 30 amp

Enquiries should give all available technical details as our relays are extremely adaptable, and many sub-standard forms are available for special duties.

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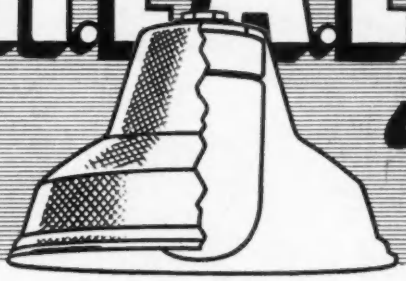
R.E.A.L tough... is tough INDEED!



This R.E.A.L. Heavy Duty fitting is typically tough! Watertight and non-corrodible, the R.E.A.L. Patent one-piece porcelain body, and the screw-neck glass globe, are protected by the 'overall' formation of the reflector, while the entire weight of the unit is carried by the Aluminium Die-cast top-member.

Remarkably clean in line, there is yet a solidity about this fitting that promises the durability it provides.

Standard Reflectors are of Vitreous Enamel Steel, but reflectors of specially treated aluminium are available where highly corrosive action has to be countered.

60, 100 and 200 watt fittings. Also with Angle-Concentrating Reflectors. Choice of Clear Glass or Crystalux Screw-neck Globes. SEND FOR LEAFLET P.9512.

Years ahead on Durability!

R·E·A·L **HEAVY-DUTY NON-CORRODIBLE WATERTIGHT FITTINGS**

Issued by ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. WORKS, BIRMINGHAM, 18

Model 8 UNIVERSAL AVOMETER

20,000 ohms per volt *plus* AUTOMATIC Overload Protection

Produced in response to a demand for a **high sensitivity** version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability. It has a sensitivity of 20,000 ohms per volt on all d.c. voltage ranges and 1,000 ohms per volt on a.c. ranges from 100 V upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials both positive and negative about a common reference point.

A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Sizes: 8¼in. x 7¼in. x 4¼in.
Weight: 6½ lb. (including leads).

£19 : 10s.

The following accessories are available to widen still further the ranges of the instrument: A Resistance Range Extension Unit to extend the limits of measurement from 0.025 ohms to 200MΩ, a 10 kV d.c. multiplier and a number of a.c. current transformers.

D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE	A.C. CURRENT	RESISTANCE
2.5 V	50μA	2.5 V	100 mA	First indication 0.5Ω
10 V	250μA	10 V	1 A	Maximum indication 20 MΩ
25 V	1 mA	25 V	2.5 A	0-2,000Ω } using internal batteries
100 V	10 mA	100 V	10 A	0-200,000Ω } using internal batteries
250 V	100 mA	250 V		0-20 MΩ } using internal batteries
1,000 V	1 A	1,000 V		using external batteries
2,500 V	10 A	2,500 V		0-200 MΩ } using external batteries

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
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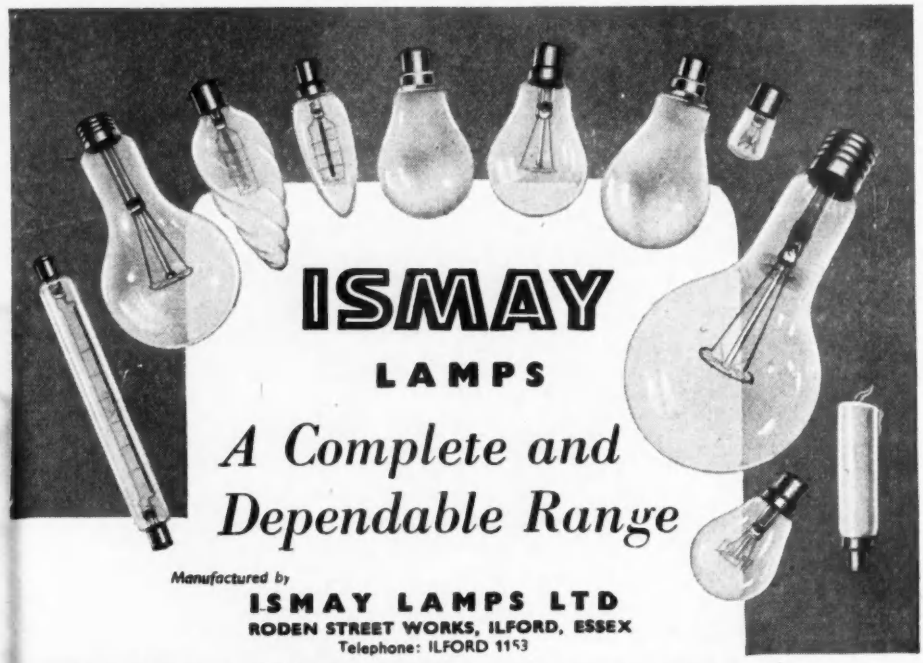

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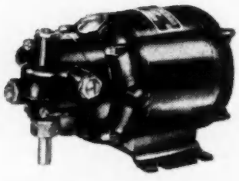
Geared
Electric Motor Units



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Max. Torque 4 lb. in.
6 in. × 3½ in. dia. $\frac{1}{80}$th H.P.

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12

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ALLOY CASTINGS

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high electrical conductivity

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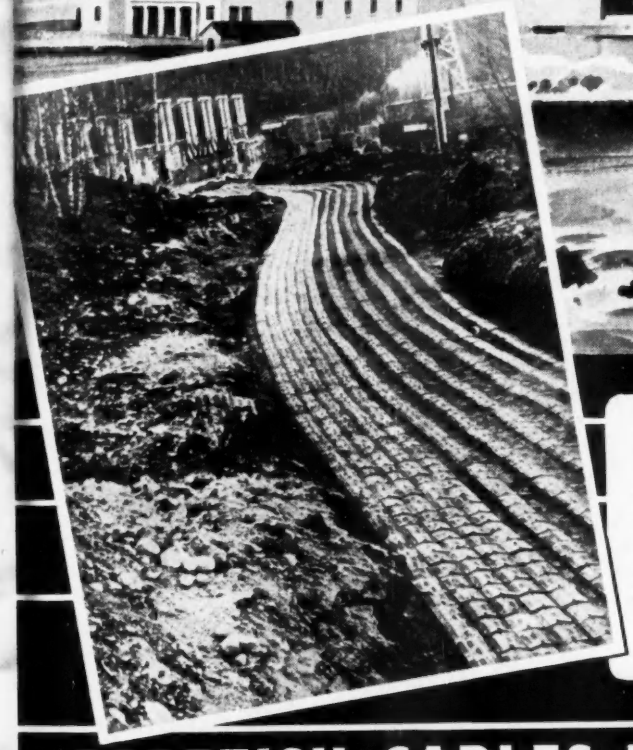

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Consulting Engineers: Messrs. Kennedy & Donkin

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- Complete temperature compensation.
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- Damping system giving complete stability.
- Simple and accessible adjustments for calibration.
- Resilient lower (jewel) bearing.
- One terminal block for all capacities.

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METROVICK *Meters, instruments and relays*

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We can get those idle machines going again with the minimum delay and, what is just as important, we can keep them going. Thirty years experience as a sort of Industrial Tweeny, specialising in mechanical and electrical repairs to all kinds of manufacturing equipment, in all parts of the country, are a guarantee that we can handle your particular problem with the maximum speed and efficiency.

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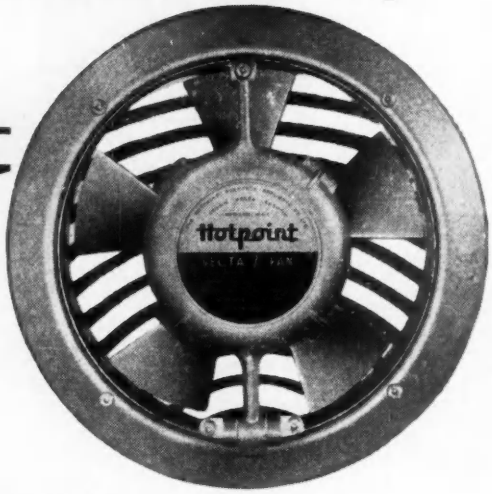
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

NOW ventilation by Hotpoint



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Before settling on a ventilating system consider and investigate this new 7-inch fan. It has been specially designed for Hotpoint whose reputation for dependability is undisputed. Engineers who added speed to the Spitfire and Hurricane and are now researching in Jet propulsion, have applied their knowledge of air movement to this fan design.

With an extraction rate of 17,500 cu. ft. an hour it is suitable for public rooms, offices and homes, flats, factories and farms. Send for detailed specification list HEA.382/1.

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THE HOTPOINT ELECTRIC APPLIANCE CO. LTD., PETERBOROUGH

Member of the A.E.I. Group of Companies

'ENGLISH ELECTRIC'

fusegear

Higher Short-circuit "Making" Capacity— 50 MVA

Previously tested at 25 MVA, 'ENGLISH ELECTRIC' combination fuse switches of the new standard shrouded pattern have now successfully passed 3-phase 440 volt short-circuit "making" tests at 35 MVA and 50 MVA.

The ratings tested were 30, 60, 150, 300, 500 and 750 amps.

Three successive "make" tests were made, after which the 30, 60 and 150 amp. combination fuse switch units were fit for commercial use without reconditioning. Only slight rectification of contacts on the larger sizes was necessary.

All 'ENGLISH ELECTRIC' combination fuse switches incorporate 'ENGLISH ELECTRIC' high rupturing capacity non-deteriorating type 'T' cartridge fuse links which are A.S.T.A. certified to B.S.88-1947 for Category of Duty 440AC5.

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QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

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F.5

"And the stuff won't even singe, Mr. Ash"

"Really, Mr. Downs?"

"Not at all, Mr. Ash. Nor will it warp or distort under high temperatures. These bobbins we made had to fit into an intricate assembly, any discrepancy would have made them useless . . ."

"How did you do it?"

"Well, we used a low pressure moulding with Fibreglass as a filler, Mr. Ash."

"Sounds very good, Mr. Downs."

"It is, Mr. Ash, and

If you want to know what plastics can do for you

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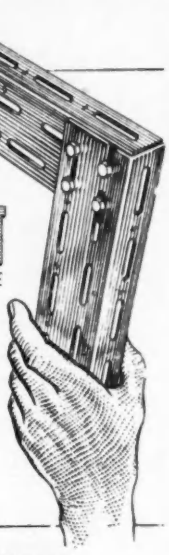
Eccleston Works, St. Helens, Lancs. Phone : St. Helens 3206. *Ashdowns Ltd. is a subsidiary of Pilkington Brothers Ltd.*

Build your own equipment with

DEXION
SLOTTED ANGLE



★ **Can be used over and over again**

★ **No drilling, measuring or painting**

★ **Just cut it and bolt it, that's all**

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RANGES : 48°-72° F or 40°-80° F
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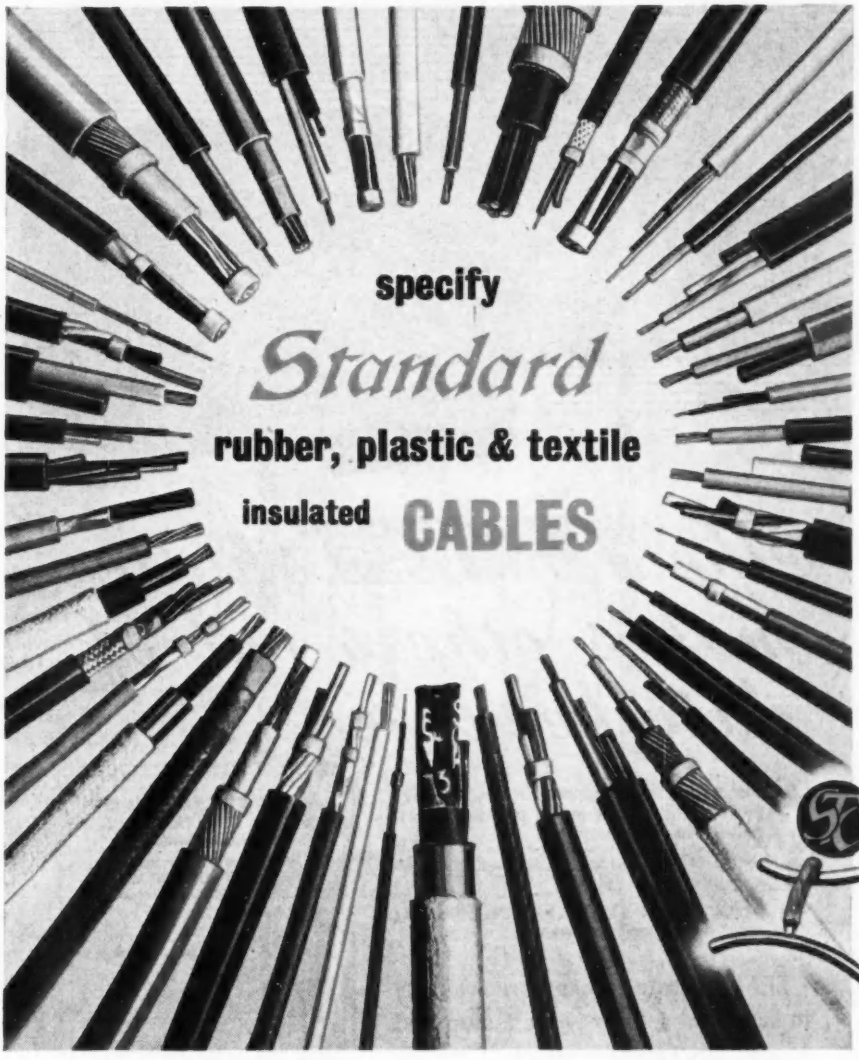


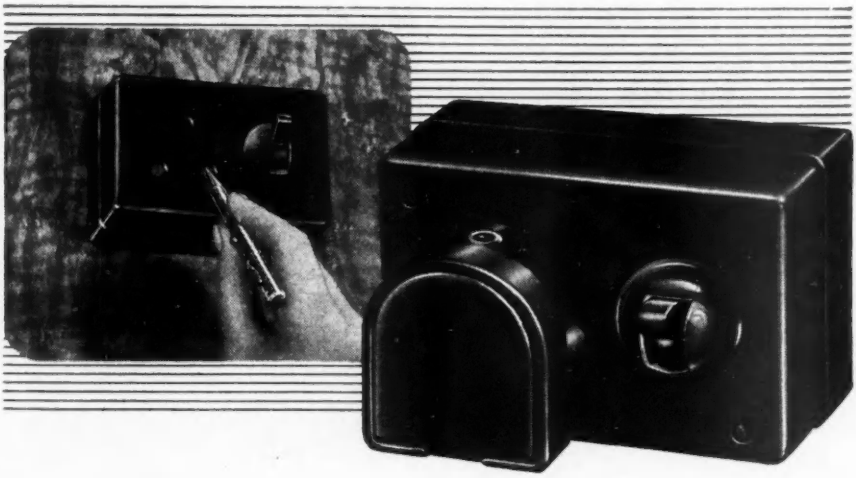
Standard Telephones and Cables Limited

(Registered Office; Connaught House, Aldwych, London, W.C.2)

NEWPORT CABLES DIVISION: 48, North Row, Park Lane, W.1. MAYfair 4392

WORKS: Corporation Road, Newport, Monmouthshire. Newport 71381

REPRESENTATIVES AND WAREHOUSES: Birmingham, Bristol, Dublin, Glasgow, London, Leeds, Liverpool, Manchester, Newcastle, Newport, Nottingham, Belfast (A. W. Gordon, Agent)



The TEMCO *shutter makes others out of date because....*

- ★ **the phase tubes cannot be exposed by pushing the shutter out of position with a pointed instrument.**
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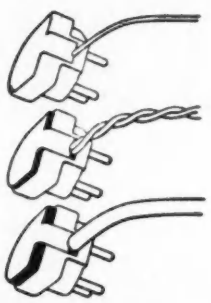
ANOTHER EXCLUSIVE TEMCO FEATURE.....
the variable cord grip.

TEMCO Plugs adjust themselves automatically to suit varying thicknesses of flex. There are no loose parts.



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Whats going on around here?

One of two 20 mile runs of 66 kV 3 phase overhead line connecting Kirkuk "B" generating station with the Zab River Pumping Station.

Erected for the Iraq Petroleum Co. by Johnson & Phillips Ltd.

Only a new electrification scheme for the Kirkuk Oil Fields in which J. & P. have cabled the new power station, designed and erected the 66 kV outdoor sub-stations and overhead lines, cabled 18 sub-stations and the process plant, and electrified a new township.

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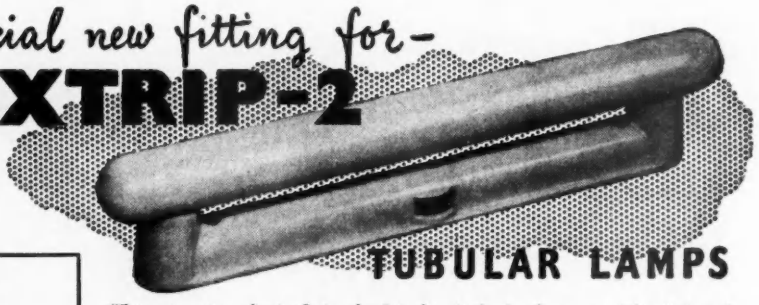
The mark that means that "little more" in quality

A special new fitting for—

MAXTRIP-2



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for
MIRRORS
CUPBOARDS
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This attractive plastic fitting by Linolite Ltd., has been specially designed to accommodate the well-known B.E.L.L. MAXTRIP—2 Lamp. It has a roller-action switch and is completely insulated for use anywhere in the home. The Lamp has the unique B.E.L.L. full-length filament for *maximum* illumination.

Are you stocking the full B.E.L.L. range of Decorative Lamps? National magazine advertising is selling B.E.L.L. to home-conscious people everywhere—take advantage of this NOW. Write for copies of the new brochure.

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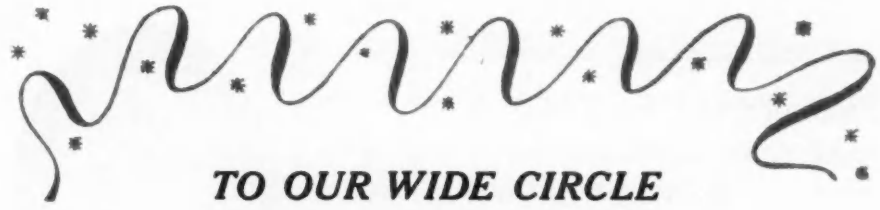
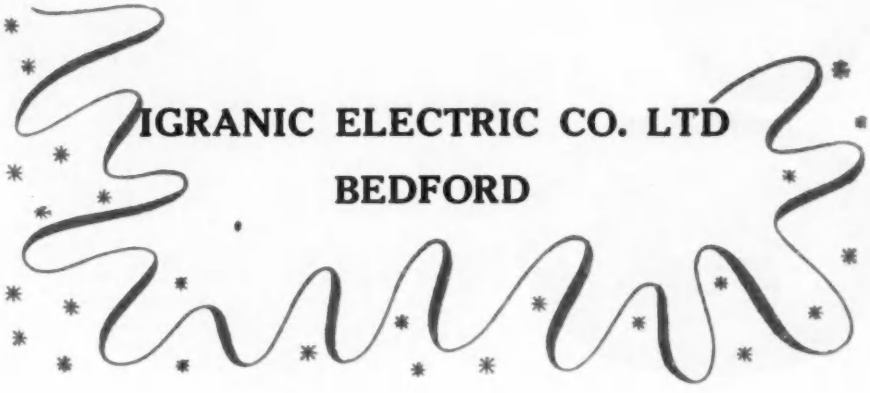


TO OUR WIDE CIRCLE
OF FRIENDS IN INDUSTRY
WE SEND GREETINGS AND
WARMEST WISHES FOR A

Happy Christmas

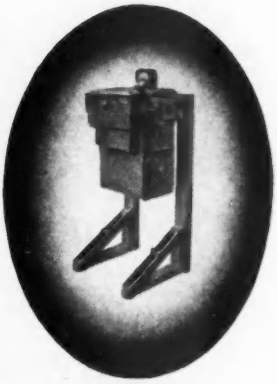
AND A

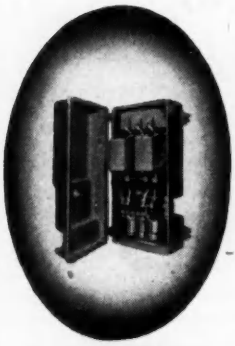
Prosperous New Year

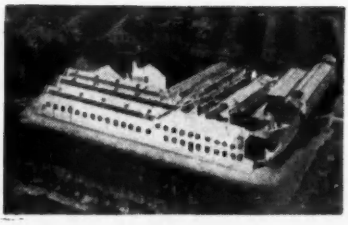


IGRANIC ELECTRIC CO. LTD
BEDFORD

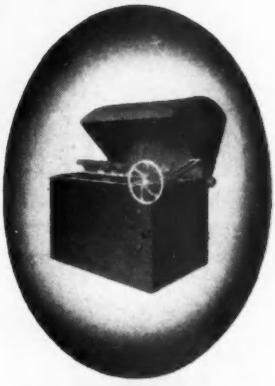
From our wide knowledge of Industrial requirements, we are always happy to recommend a type of **Starting Gear for subsequent standardisation...**

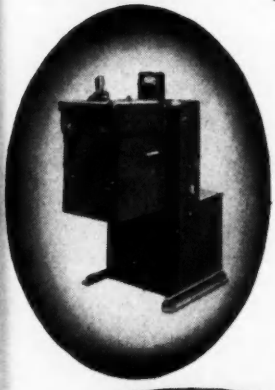






We shall be especially pleased if you would call at the Lancashire Switchgear Works in Manchester to see where 'Erskine Heap' Switchgear and Motor Control Gear is manufactured.





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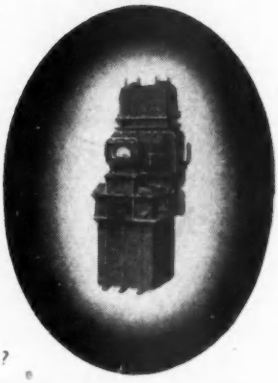
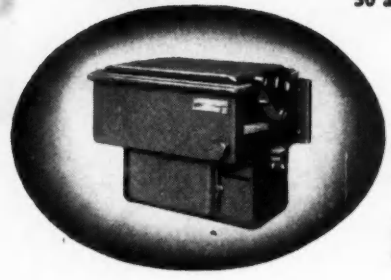
CONTROL GEAR
¼ h.p. up to 5,000 h.p.

SWITCHGEAR
50 amps./5000 amps.





May we have your enquiries?

ERSKINE, HEAP & Co LTD
SWITCHGEAR SPECIALISTS

Head Office & Works — **BROUGHTON, MANCHESTER (7)**
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BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

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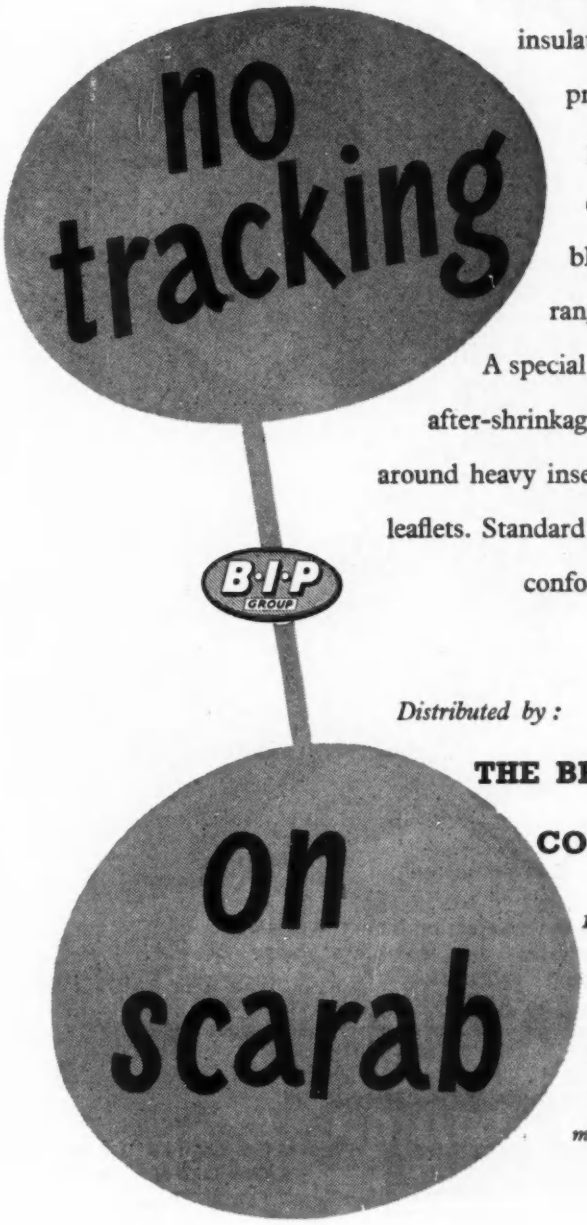

Mouldings made from Scarab moulding powder are mechanically strong, have good insulating and high non-tracking properties. Scarab moulding powder is inexpensive and easy to mould: it is made in black and brown, and a wide range of attractive colours.

A special plasticised grade with low after-shrinkage is supplied for moulding around heavy inserts. Write for technical leaflets. Standard Scarab moulding powder conforms to BS.1322, Type U.

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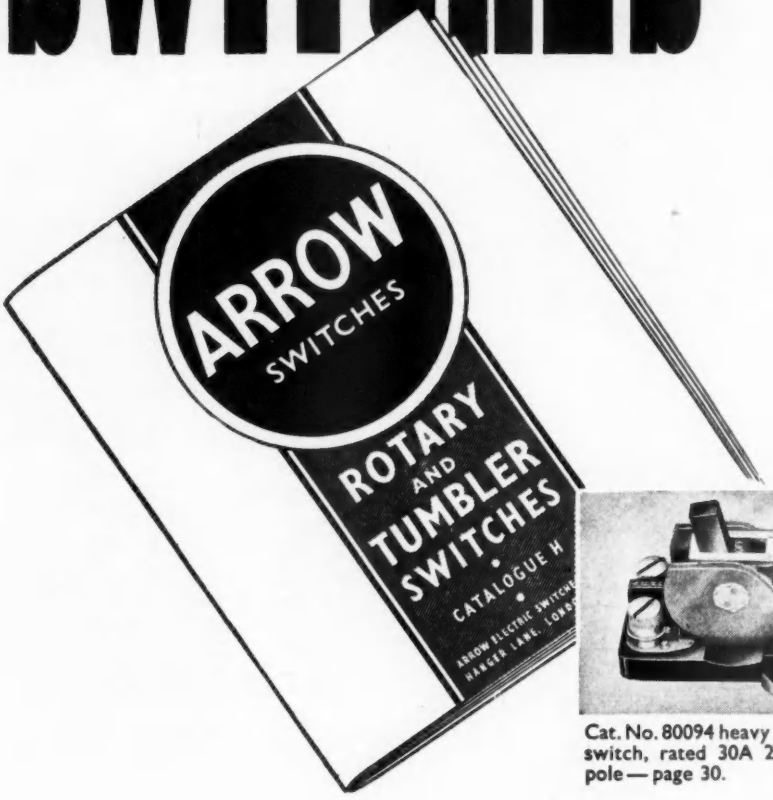

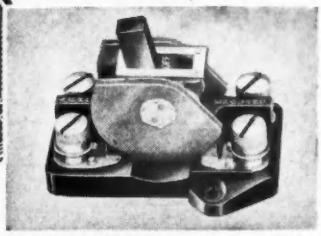

Cat. No. 80094 heavy duty tumbler switch, rated 30A 250v. double-pole — page 30.

Yet another selection from the catalogue which illustrates our complete range of precision-built switches.

There is an ARROW tumbler or rotary switch, relay or control unit to suit *your* requirements.

Write today for Catalogue 'H'

ARROW ELECTRIC SWITCHES LTD

HANGER LANE · EALING
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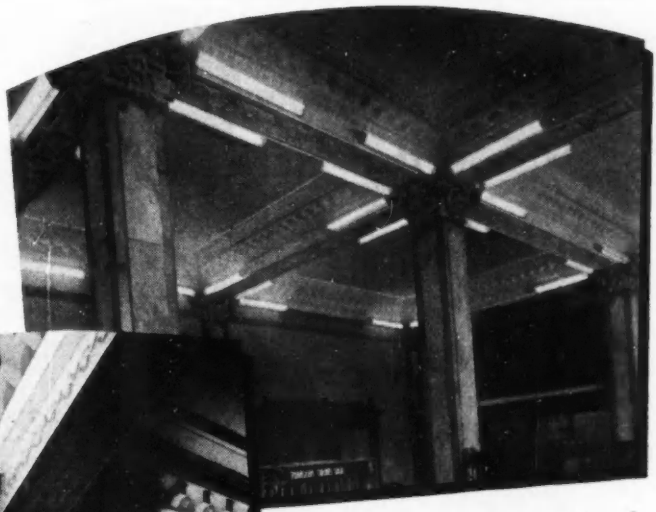

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Messrs. FRAIS & PARTNERS.

Fitting Cat. No. G.B.24

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EFFICIENT *Lighting*

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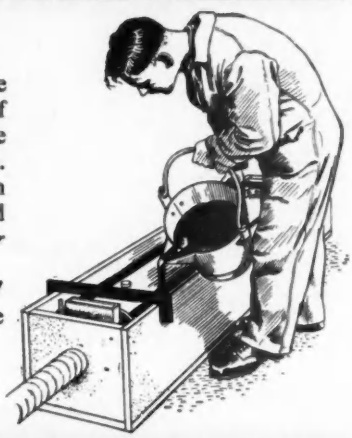
It's the compound that matters . . .

and BICC make the right compound

Choose the right compound—that's the first essential—and you have the makings of a perfect joint; and for every type of cable joint, BICC can supply the right compound. For nearly seventy years we have been developing a wide range of carefully blended compounds, for our own use—and for *your* use too.

Let us send you Publication No.257W giving full technical information on the range of BICC Joint Box Compounds.



B.I. JOINT BOX COMPOUNDS

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

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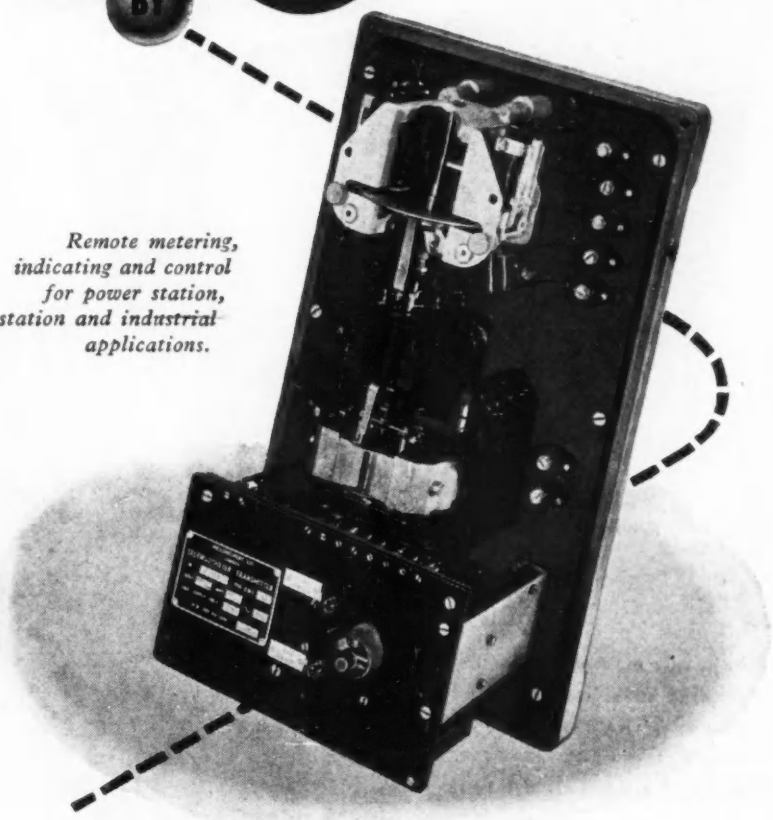
We are one Company operating in three different fields. In this advertisement we illustrate a product of the Remote Control Division.

Remote metering, indicating and control for power station, sub-station and industrial applications.



MEASUREMENT LTD

ELECTRICITY METER DIVISION, Tameside Works, Dobcross, Near Oldham, Lancs. Tel. No. Delph 291

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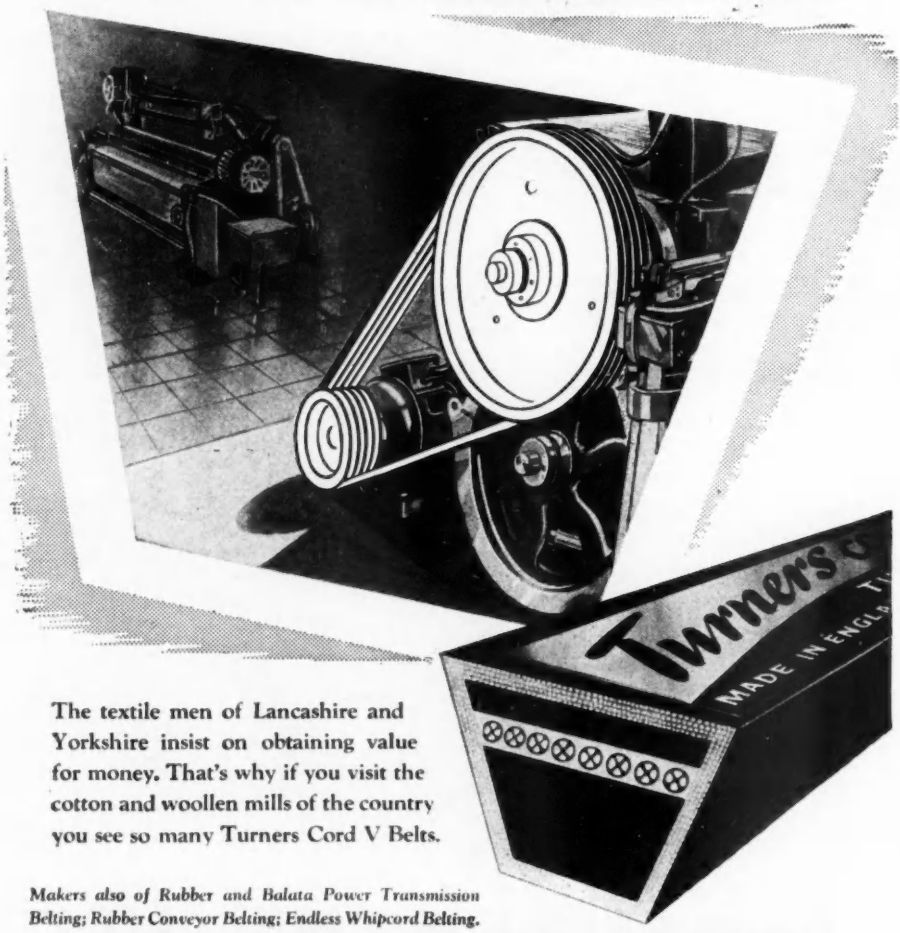
A Company of the Parkinson & Cowan Group

☆ TURNERS CORD V BELTS . . .
serve the TEXTILE INDUSTRY



The textile men of Lancashire and Yorkshire insist on obtaining value for money. That's why if you visit the cotton and woollen mills of the country you see so many Turners Cord V Belts.

Makers also of Rubber and Balata Power Transmission Belting; Rubber Conveyor Belting; Endless Whipcord Belting.

TURNERS CORD V BELTS
MADE TO B.S.S. 1440/1948

★ TURNER BROTHERS ASBESTOS COMPANY LTD
ROCHDALE · ENGLAND
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V19

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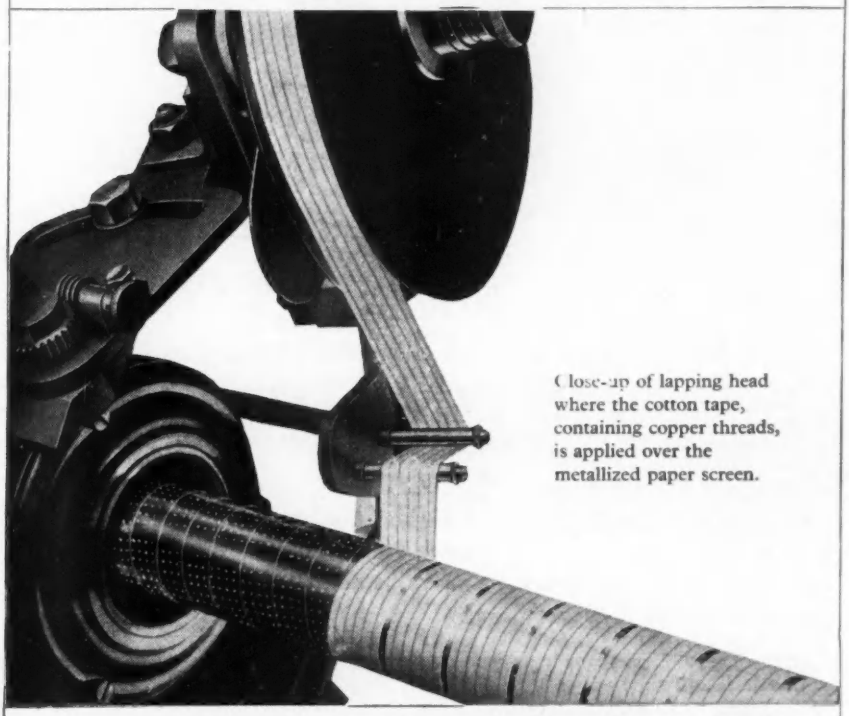
If you need cables of any type, in any quantities, for any installation, be sure of *one* thing: if you choose to deal with any firm listed below you will know for certain that the standards of design and quality are the highest possible, because they are standards set, rigorously kept and constantly reviewed by C.M.A.

AND ONE OF THE MANY FACETS OF CABLE MAKING:



Close-up of lapping head where the cotton tape, containing copper threads, is applied over the metallized paper screen.

MEMBERS OF THE C.M.A. & AFFILIATED MANUFACTURERS' ASSOCIATIONS

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CABLE MAKERS ASSOCIATION 52 54 HIGH HOLBORN, LONDON, W.C.1. PHONE: HOLBORN 7633

OBNUBILATION

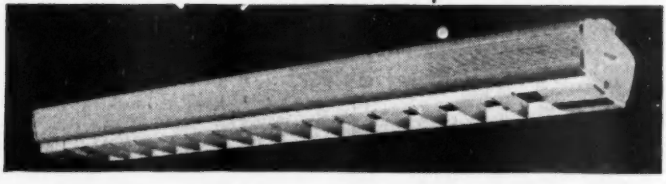
(The act of obscuring, darkening)

in the office, causes

SLOW WORK · CARELESS MISTAKES · LOW MORALE

IN AN OFFICE where tempers are short, faces long and the work slow and inefficient, the cause of the trouble often vanishes away simply by installing Philips Fluorescent Lighting, planned to bring a clear, restful, diffused light to every desk in the room.

The handsome "Abingdon" fitting contains two 80w. 5 ft. Philips fluorescent lamps. Other suitable fittings for offices :—"Alva" and "Arundel".



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PHILIPS ELECTRICAL

LIMITED

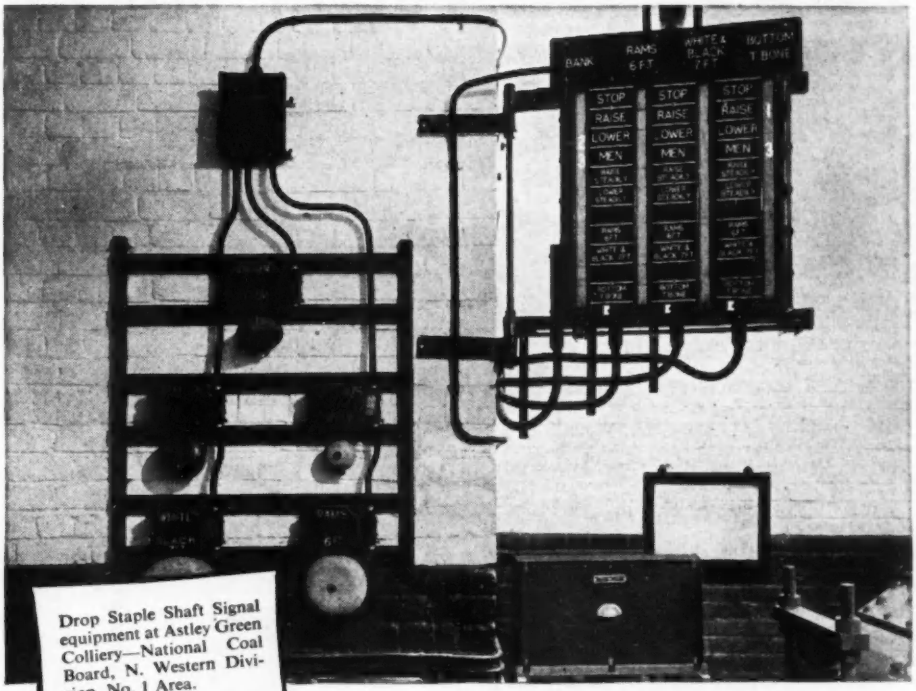
on all lighting problems

LIGHT GROUP, CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

Makers of: Radio & Television Receivers, "Philishave" Electric Dry Shavers, etc.

(LD963)

Intrinsically safe
STAPLE SHAFT SIGNALLING SYSTEM



Drop Staple Shaft Signal equipment at Astley Green Colliery—National Coal Board, N. Western Division, No. 1 Area.

Developed by "A.T.M." for use in unsafe atmospheres, this Staple Shaft Mine Signalling Equipment provides the statutory code of signals prescribed under the Mines Act. A total of ten signals is provided.
Certified bells of varying tones provide the audible signals. Visual signals are provided by the "A.T.M." Indicator which is flameproof when used in conjunction with safe relay groups.
The certified relay apparatus which controls all signals is installed in a compact metal cabinet. The "Emergency Stop" signal overrules all previous signals and is effective whether the cage is moving or at rest. This equipment is connected to a certified transformer.

ATM STAPLE SHAFT mine signalling equipment

Please write for full details:

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.

Strowger House, Arundel Street, London, W.C.2

Telephone: TEMple Bar 4506 Telegrams: Strowger, Estrand, London

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A.6581-C23

ASEA A.C. ELECTRIC PULLEY BLOCKS

These blocks are made for arduous industrial conditions and can be fitted with the inching or creeping speed attachment, giving hoisting or lowering control to within limits of 0.02". The attachment operates on simple straightforward principles and is made to the same high standards as the main machine.

The Pulley Block is ideal for Foundries, Machine Shops, Assembly Bays and other situations where critically fine control is essential.

Models as illustrated up to 2½ tons, alternative design available up to 5 tons.

ASEA ELECTRIC, LTD.
Associated with Fuller Electrical & Mfrg. Co. Ltd.
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Lloyds Bank Building, King Street 74 York Street Hendon House, Fleet Street
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THE FM METER

The unequalled performance of the Ferranti F.M. Meter is largely due to an anisotropic magnet of unusual power having 14 times the magnetic energy of Tungsten steel and 4 times that of 35% Cobalt.

FERRANTI LTD.

HOLLINWOOD · LANCASHIRE · ENGLAND

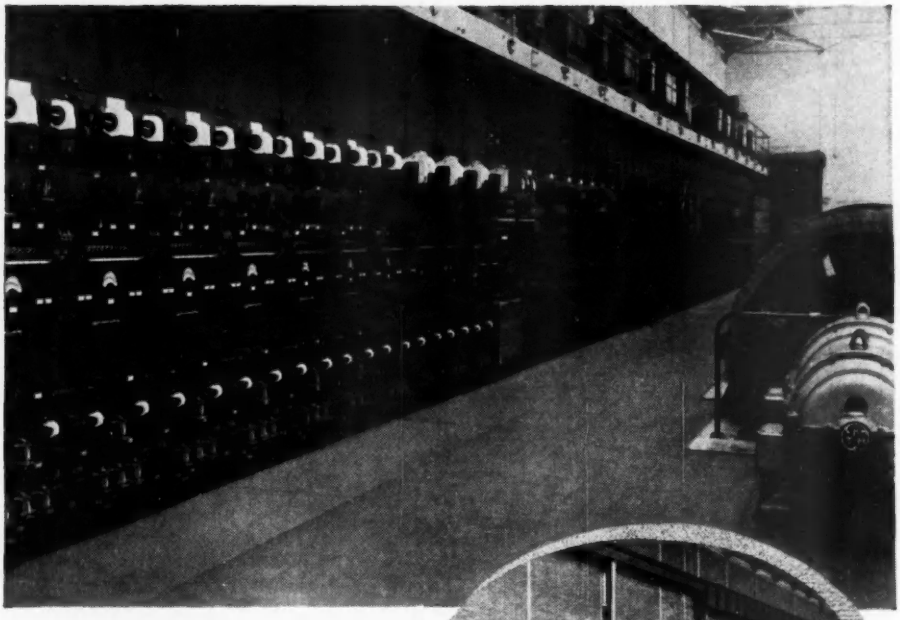
London Office: Kern House, Kingsway, W.C.2.

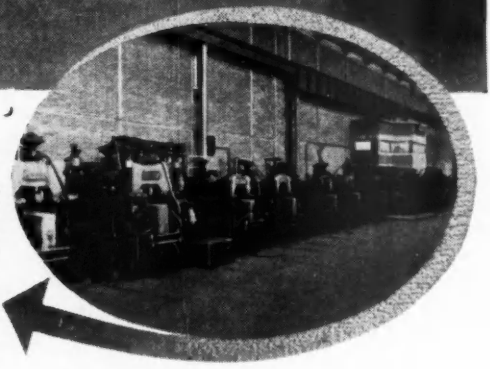
FM94

C

B T-H

CONTACTOR CONTROL for Heavy Industry





The CONTACTOR EQUIPMENT illustrated is controlling seventeen motors totalling 6,850 h.p., a 6,000 h.p. motor driving a motor-generator set, and various other auxiliary drives. Inset is shown the roughing train of the Merchant Rod Mill at the Tremorfa Works of Messrs. Guest, Keen and Nettlefolds (South Wales) Ltd., Cardiff. For more than forty years BTH has held a position of leadership in the development of automatic "finger-tip" control of heavy electric plant through the medium of contactors. These contactors, designed by experts, are proved by protracted "life tests" before going into service.

Where only the best is good enough—

Specify BTH Contactor Control

THE

BRITISH THOMSON-HOUSTON

COMPANY LIMITED, RUGBY, ENGLAND

Member of the AEI group of companies

A916

NALDERS

Indicating & Recording INSTRUMENTS

For QUALITY • ACCURACY • DEPENDABILITY

FREQUENCY METERS

PRECISION TYPE

N.C.S. Frequency Meters of Precision Type comply fully with B.S.S. No. 89—1937 for short-range precision accuracy, being within 0.1% of the mean value of the frequencies shown on the scale. The instruments are independent of voltage and temperature variations over wide limits and develop no self-heating errors. Low v.a. consumption. Supplied with 90, 150, or 200 deg. scales.

INDUSTRIAL TYPE

Industrial Type Frequency Meters are also available in all sizes from 4 in. to 12 in. diameter dials with 90 deg. scales (approx.).

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ELECTRICAL TIMES

Vol. 120 No. 3137 THURSDAY, 20 DECEMBER, 1951

PUBLISHED EVERY THURSDAY

SIXTY-FIRST YEAR OF PUBLICATION

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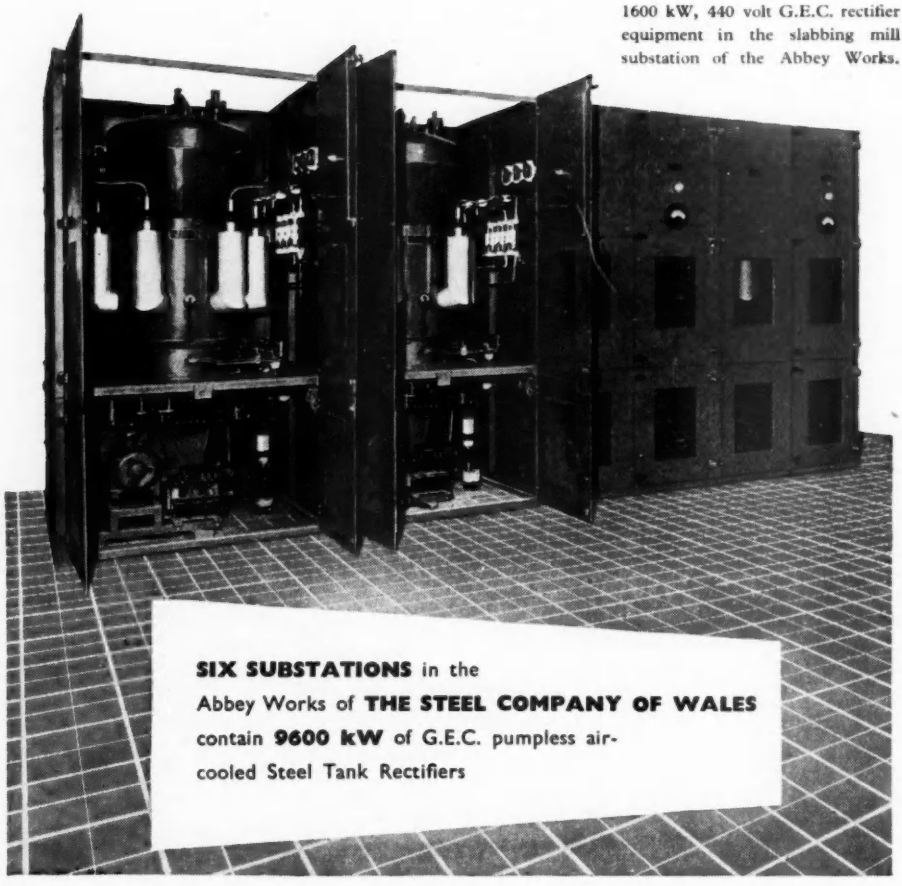
G.E.C.

Steel Tank Rectifiers

FOR STEELWORKS

1600 kW, 440 volt G.E.C. rectifier equipment in the slabbing mill substation of the Abbey Works.



SIX SUBSTATIONS in the Abbey Works of **THE STEEL COMPANY OF WALES** contain **9600 kW** of G.E.C. pumpless air-cooled Steel Tank Rectifiers

THE GENERAL ELECTRIC CO., LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Editorial

CUTTING THE CONVENTION?

IT is with mixed feelings that the industry will learn of the moves to curtail the British Electrical Power Convention to 2 or 3 days only. In the 55 years since the first of these annual events was held, they have become part of tradition in this industry. To vary the familiar formula comes as something of a shock, yet in the changed circumstances of the industry it was difficult to conceive that there would be no change in this, its major gathering of the year. But curtailment of the Convention will add nothing towards solving the problems that have arisen under these new conditions. Nor will it provide a reduction in expenses comparable with a shorter period. By all means let there be economy, and there is certainly room for it, but this could be achieved by means other than restricting the programme. It is not curtailment that the Convention needs, but a renaissance and the prerequisite of this is a clear recognition of the purpose it serves. To this purpose must be subordinated all other considerations and delegates should be chosen from those who can and will contribute to this end. Only in this way will the industry obtain a Convention worthy of the part it has to play in the nation's welfare.

THE WILLING HORSE

THE skeleton of the dollar deficit has again emerged from its cupboard, where it has been temporarily concealed by the U.S. stockpiling programme and the rise in raw material prices. Now, with the trend towards a buyers' market the problem of the shortage of dollars has become more acute than ever, particularly as some of the former dollar earners such as motor cars and textiles have suffered a serious recession. Under such conditions the reconstitution of the D.E.B. with the distinction of a new constitution and new title, the Dollar Exports Council, is, unquestionably, a right step. Their task will not be an easy one with the present shrinking markets and in the initial stages they must look to those industries which are expanding their sales in the dollar area and in the forefront of these is the electrical industry. The export returns for electrical goods to Canada and the U.S. show a continuous and substantial increase. Unfortunately, a full geographical breakdown of electrical machinery exports is not published, but there is little doubt that the story for heavy plant is at least as good. So far, the record has been substantial, but it is clear that the electrical industry is destined to play an ever larger part in the task of closing the dollar gap.

LIGHTING IN TROUBLE

STUDY of any lamp fittings manufacturer's catalogue suggests that a wide range exists to meet the needs of architect or factory engineer who has an illumination problem to solve. In fact, most people's impression would be that the main difficulty was one of selection from the plethora of fittings available. It is thus with something of a shock that some comments in the D.S.I.R. Building Research report are noted: dissatisfaction with artificial lighting units is reported from post-war schools, and the architects are stated to be unhappy about technical details as well as aesthetics of design. The research station staff appear to support such opinions, and it is specifically stated that common practice often fails to meet established recommendations. More than this, such standards are

The Editor
Wishes You
A Merry Christmas

inferred to be inadequate. Something of the same sweeping accusation is repeated with respect to industrial lighting, for which a lack of really suitable fittings is alleged. It is unfortunate that little detailed information is given of the basis for these charges; they are severe enough to demand close examination.

PLAN FOR LONDON

COMPREHENSIVE plans for the redevelopment of London must have indirect effects on industry throughout the country, and the statement on its policy for the coming 20 years, which the London County Council made last week, will repay study by all businessmen. In common with most recent plans, part of the policy is the grouping of factories into designated industrial areas, with the aim at closing down all that are outside such boundaries; to some extent this means that increasing reliance is being placed on successful development of the new towns to take displaced works. All this, of course, will have its considerable effect on electricity generation and distribution arrangements: replanning of roads must, alone, mean much rearrangement of mains, while the changed nature of different neighbourhoods and altered population densities in residential districts will alter demand characteristics and service requirements. Though the total period that the plan covers is 20 years, work is to begin shortly. It will not go through to a successful conclusion unless the varied interests involved, decide at once to adopt a sympathetic attitude to the whole grand concept.

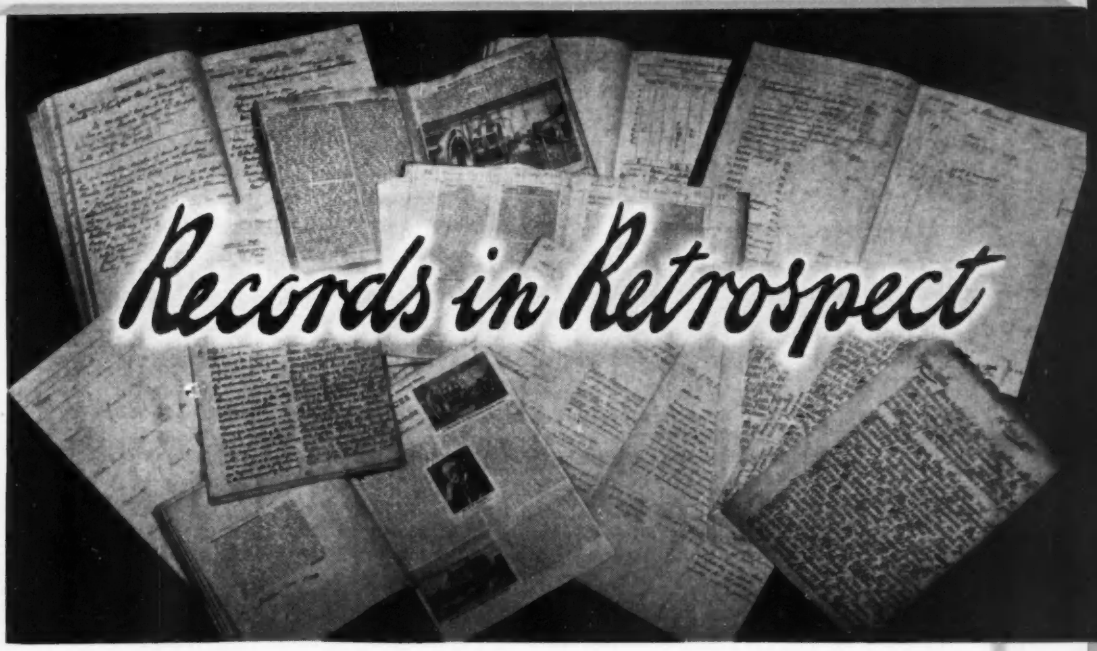
AID IN REVERSE

AN interesting variation on the old alternating versus direct current controversy is to be seen in the report of the productivity team which went to the United States to study coal mining practice. American mines are almost entirely electrically powered, but due to the growth of electrification from its beginnings in an electric-train underground haulage system, they employ direct current machinery. Add to this the reliance that is placed on the train trolley wires as the distribution cabling feeding both trains and tools, and a voltage regulation problem of the first magnitude is to hand. Introduction of alternating current supplies for coal-face machinery seems the obvious, if expensive, answer, but the opponents of such a step foresee some loss of the undoubted flexibility that the d.c. trolley wire distribution system gives. Those who drew up this report feel that the change-over must come, and warm themselves with the thought that when the American coal industry eventually faces up to the problem, it will be able to learn a lot from British practice.

FUEL POLICY GOES MAD

THE nonsense that is uttered on the subject of fuel policy and of electric heating in particular, continues to increase in volume, until one wonders whether a clear picture of the situation will ever be recovered from the rubbish that has been heaped upon it. The latest Don Quixote is Professor Simon who is best known for his work in the field of very low temperature. He now proposes that the Government should provide closed stoves for every home, pointing with pride to the saving of 15 million tons of coal at a modest cost of £30 m. Such items as the production of the large quantity of slow-combustion fuel needed, the iron required, and the present restriction on capital expenditure are matters that he feels can be left to others to solve. Professor Simon also has an original solution for the troubles which beset the electrical industry. It is simply the imposition of penal tariffs on all electricity consumption in excess of the legitimate requirement of the consumer. What a wonderful opportunity is here for our bureaucratic masters; the legal definition of legitimate requirements must be great fun. It is quite understandable that with such views on fuel problems, Professor Simon has been adopted by the ladies of the Women's Advisory Council on Solid Fuel and they arranged a special meeting last week in order to provide a wider audience for these proposals. Do they really think that the airing of such views is in the best interests of the nation or even of their own policy? It is difficult to avoid feeling the whole affair is rather pathetic.

Meteor



Some Glimpses of the Pioneering Days recalled by E. H. JESTY, A.M.I.E.E.

THE modern generation of electrical engineers may think that load shedding, and power failures are a present-day symptom. At the beginning of the industry they were of not infrequent occurrence. Administration and operation had their complexities and the following series of notes taken from past records may prove enlightening to the younger and rouse half-forgotten memories in the minds of some of the older power supply engineers. They can also give inspiration to those in between who are daily struggling against heavy odds with complicated problems.

The pioneers, as will be seen, had difficulties not so very different from our own, and if they had the advantages of low costs, and no labour or fuel shortages, they were not unacquainted with "load shedding" due to "technical hitches."

The practical engineering giants of the past, many of whom achieved the eminence of becoming the President of the Institution of Electrical Engineers, were very human souls, as some of these notes reveal.

UNDISCIPLINED STAFF.

(*Things are not what they used to be!*)

MR. C. H. WORDINGHAM TO MR. C. P. SPARKS
20th November, 1890.

"It is impossible to carry on the work of the Department if I have no control over it. One of your men today, without a word to me, took away a tenon saw and used it for cutting cable.

"The moral effect of this sort of thing (in addition to the actual damage done to the tools) on the men, is very bad.

"I consider it my duty to bring this matter before you, and to beg you put a stop to it, distasteful as doing so is to me."

METERS FOR ALL CONSUMERS.

(*The penalty of Progress!*)

C. H. WORDINGHAM to S. Z. DE FERRANTI
10th September, 1890.

List of meters required to furnish *all* consumers with meters.

Mercury meters max. cap. 100 amps	22
ditto converted wood (*sic*)	10
Ferranti—Wright—Borel max. cap.	
40 amps	16
ditto 20 amps	13
ditto 10 amps	6
ditto 5 amps	11
Total	78

RECALCITRANT CONSUMERS.—

(*Is the Consumer always right?*)

C. H. WORDINGHAM to THE ACCOUNTANT
25th November, 1890.

"Messrs. S——— & Co. Bond Street refused to have a meter installed. They say they had only seven 8 c.p. lamps as an experiment and if they like the light they will have the whole of the premises wired and would then raise no objection to having a meter!"

SPACE HEATING.—

(*By Mr. Therm's grand-father?*)

MAJOR C. B. WALLER (Manager of an Electric Supply Co.) to Gas Light and Coke Co.
5th December, 1890.

"I should be obliged if you will let me have a stove similar to the one you have just sent for the Store-keeper's Office."

REMUNERATION.—

(*A little reward sweetens labour.*)

P. WALTER D'ALTON to MAJOR C. B. WALLER.
25th April, 1892.

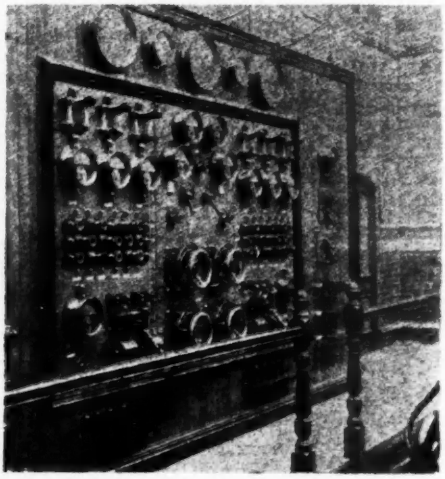
"The M——— Company employs one Chief and 21 Assistants = £3,760 per annum.

Your Company employs one Chief and 9 Assistants = £2,080 per annum.

The full pay of the 28 *men* for the running shifts is £2,392 per annum.

It is difficult to see how further economies can be made."

An outstanding example of "modern" switchgear is this control panel at Burnley Corporation's generating station which was opened in 1894



SUBSTATION RUNNING REPORT
26th February, 1892.

TRAFALGAR DISTRIBUTING STATION

Station ran *all* circuits from 6 a.m. to 1.34 p.m. and from 12.36 a.m. to 6 a.m. (27/2/92).

" " its *own* load from 1.35 p.m. to 12.36 a.m.

Pressure on Nos. 3 and 4 trunk mains all day.

Max. load on No. 3 Trunk = 11½ amps at 10,000 V 12.30 p.m.

Max. load on No. 4 Trunk = 23¾ amps at 10,000 V.

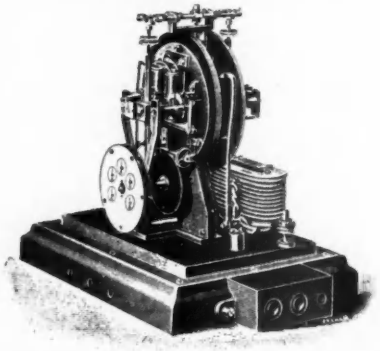
Load at 5 p.m. = 115 amps at 2,400 V.

CIRCUITS OFF

No. 3 from 3.3 a.m. to 4.45 a.m. to admit of G.G. (Grosvenor Gallery) end being connected to switching gear.

VARIATIONS IN PRESSURE

9.11 a.m.	Between 93 V and 102 V. (Changing machine)	1 minute
1.5 p.m.	All lights out. 5 seconds (Something wrong at Deptford)	
1.6 p.m.	Between 90 V and 102 V. (Changing machines)	5 minutes
3.0 a.m.	Between 99 V and 112 V. (Changing machines)	4 minutes



The principle of the "General" meter introduced by G.E.C. in 1893 is "that of the action of a magnetic field on a swinging magnet"

SAFETY PRECAUTIONS

(*Autres Temps, Autres Moeurs*)

CHIEF ENGINEER TO MANAGER AND SECRETARY
23rd January, 1894.

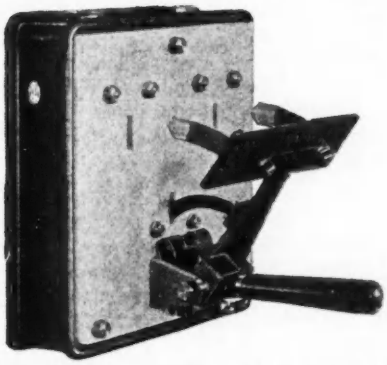
"I have pleasure in reporting that since Friday, December 8th, '93 the continuity of supply has been admirably maintained . . . the quality of our light has been better than anything we have previously supplied."

(*It appears that a coroner's jury had recently added to a verdict a rider suggesting the*

provision of rubber gloves and posted Safety Rules, for the Chief Engineer goes on to say):

"I entirely disagree with these recommendations. . . . In the first place the gloves would need to be at least $\frac{3}{8}$" thick, if not $\frac{1}{2}$" and no man could work with them on. In the second place the moment these gloves became in the slightest degree dirty the surface leakage would render them useless . . . their presence in the Stations would only encourage men to rush foolishly and unnecessarily into danger.

"I have no objection to drawing up rules and exhibiting them . . . but I do not recognise that they can be of any possible use in a Station which is only worked by men who have an intimate knowledge of the exceedingly simple duties to be performed."



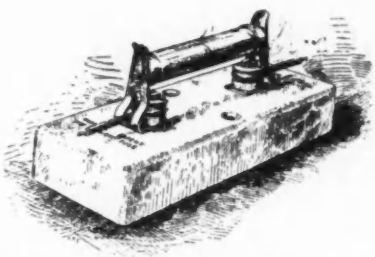
"Verity & Steel's new patent high tension switch and fuse introduced in 1899 *. . . designed to meet central station requirements . . . No current carrying parts whatever are exposed, the contact blades being effectively shielded by an insulating guard. Any part of the front of the switch can be handled whether the switch be on or off"*

(*The "exceedingly simple duties" included changing of "live" fuses at* 2,400 *volts, and "burning down" faults with* 2,400 *volts applied to an ordinary pail of water in series with the faulty main.*)

CABLE TESTS (*Rough and Ready method*)

MR. G. W. PARTRIDGE'S NOTEBOOK
16th January, 1890.

"Concentric jute cable, 2,400 volts, fuses on inner and outer. Passed 2 amps through cable. Cut cable with an axe. Fuses failed *at once*. Damped handle and blade of axe and repeated test. No shock felt. Placed cable in fire devil, after a few minutes fuses failed as cable shorted after insulation had burned."



This H.T. fuse, invented by Mr. Mordey, "consists of one or more copper wires enclosed in a short glass tube and surrounded by a non-conducting and incombustible powder which effectually quenches the arc." Introduced by the Brush Company in 1893, *it is surely the forerunner of the modern cartridge fuse*

VOLTAGE DROP (*Consumer's Installation*)

CHIEF ENGINEER TO "GENERAL PURPOSES COMMITTEE" 13th March, 1894.

"I have suggested to St. Stephen's Club that in order to overcome the bad lighting due to insufficient area of their copper that lamps of 96 volts should be used on the top floor, 98 volt lamps on the second floor and ordinary 100 volt lamps on the ground floor."

CHRISTMAS MYSTERY

CHIEF ENGINEER TO MANAGER
1st January, 1895.

"I have to report that unfortunately the supply was interrupted for one hour and twenty minutes on Tuesday (Christmas Morning) from 12.35 to 1.55. The matter has been thoroughly investigated by you and we have not the slightest fear of a similar occurrence again happening."

* * *

What an intriguing and topical note on which to cease this calling-up of spirits from the past!

Diligent search has failed to reveal any more concerning this mysterious shut-down. Can it be that Santa Claus fouled some roof-top cables in his wanderings, or interfered with the draught by trying to descend the power station chimney?

At all events, the gallant pioneers made sure that it will not happen again, and we may take our leave of them with the Yuletide greeting, "God rest you merry, gentlemen."

The illustrations in this article are reproduced from early issues of the ELECTRICAL TIMES.

In the heading block are seen some of the records from which these notes have been selected.

Our readers' views . . .

Shortage of Cardboard

IN company with many of your readers, we are users of cardboard boxes and cartons for packing certain of our products whose shape makes them difficult to store by retailers or wholesalers, unless they are so packed.

The present general shortage of raw materials for card making is causing us some concern, and there seems little likelihood that the position will improve for some considerable time.

Clearly a very high proportion of available card is devoted to the manufacture of cigarette cartons, and we are wondering whether the electrical trade as a whole, and particularly the manufacturers of small domestic electrical appliances, has considered the possibility of persuading the tobacco companies to introduce certain economy measures.

We suggest, for instance, packing cigarettes in twenties only, or packing tens in paper wrappers as was done to some extent during the war.

Alternatively, it is thought that some form of government control in the allocation of card on a priority basis is justified. We should be very interested to hear other readers' views on this vexed question.

D. & S. LTD., MANCHESTER. *M. W. Mallett*

British Standard Earth Clip

WE thought it would interest your readers to learn that, as far as we know, there is no earth clip manufactured to British Standard Specification 951, with the exception of the type shown in B.S.No. 951, pages 14 and 15.

Our object in trying to find such a clip results from our efforts to standardise the electrical equipment used on our plant. We are therefore adopting the recommendations of the British Standards Institution wherever possible.

If any reader knows of a manufacturer who produces this standard clip, we shall be glad to have this information.

KODAK LTD., WEALDSTONE, MIDDLESEX. *P. H. Johnson*

Gas Turbine Locos

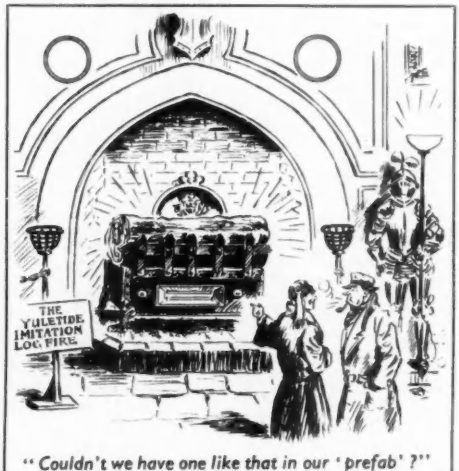
I AGREE entirely with the comments made in Mr. Field's letter published in your issue of December 13. Mr. Field assumes, however, that I am in favour of railway electrification as opposed to the gas turbine locomotive. This is not strictly so. My main object in writing was merely to point out that while pros and cons are being argued, conventional steam locomotives will continue to use inefficiently our available coal, and this should, at all costs, be avoided.

LONDON, W.C.1. *J. Jay*

B.E.A. Quiz

1. What are the principal differences between the form of the B.E.A. bulk tariff and the former C.E.B. bulk tariff?
2. Which area board sells most electricity?
3. How many electricity boards in the U.K.?
4. Which area board has the largest number of industrial consumers?
5. What is the legal difference between the British Electricity Authority and the Central Authority?
6. What appointment in the present Government restores an association with the supply industry which existed up to 1941?

ANSWERS: 1. The C.E.B. fixed charge was stepped according to demand, and was subject to variation in accordance with power factor and the sum paid by way of rates. 2. North Western Board. 3. Sixteen. 4. London Board. 5. There is no difference. 6. Lord Leathers is co-ordinating Minister for transport and electricity supply. From 1919 to 1941 the Minister of Transport was the responsible Minister for electricity supply.



"Couldn't we have one like that in our 'prefab'?"

RECTIFIER-MOTOR DRIVES

Advantages for Variable Speed Applications

METHODS by which glass-bulb, mercury-arc rectifiers are used with shunt-wound d.c. motors to provide variable-speed drives for industrial machinery were analysed before the I.E.E. Utilisation Section by MR. P. BINGLEY, A.M.I.E.E. (Hackbridge and Hewittic) at a meeting held last Thursday. The paper then presented opens with a historical review of the development of the subject, but soon passes to a short statement of desirable motor characteristics and a note on one aspect of rectifier characteristics—interphase reactor rating.

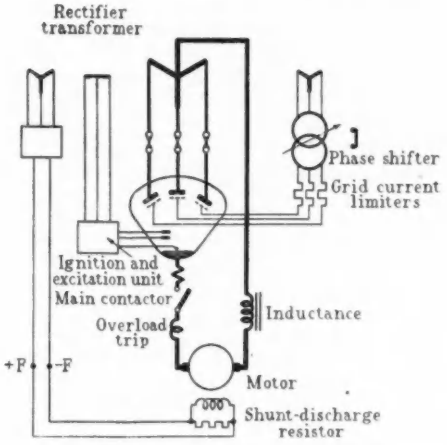


Fig. 1. Principal connections for a rectifier motor equipment using three-phase rectification

Various methods of motor feed are possible, but when grid controlled rectifiers are used it is found that, for a particular speed setting, there is a critical torque below which the speed rises rapidly with further torque reductions. This corresponds to the change in the rectifier output from a continuous to a discontinuous state, the motor armature in the latter situation being fed with a series of current pulses. The limiting condition for current continuity occurs when the peak value of the ripple current is equal to the average of the load current: this can be expressed mathematically in terms of excitation and firing angles.

The general practical problem presented by this phenomenon is the critical value of inductance required to ensure current continuity over the working range. Inductors are not usually designed for a particular application, but are rather selected from curves and from standard designs. For small h.p. drives employing servo speed control discontinuous current operation may be accepted. Special precautions must be taken to avoid high voltage due to motor overdrive, and against surges due to "ion deficiency" resulting from low temperature (below 10° C) working. In all cases, suitable designs can be prepared only if a good knowledge of the characteristics of the drive is available.

Probably the simplest method of obtaining a field supply is to install auxiliary selenium rectifiers, but if requirements are large an auxiliary bulb may be used. It is possible to obtain a supply by using auxiliary anodes on the main rectifier, but several disadvantages attach to this method.

Armature Voltage

Armature voltage may be varied by several methods, but grid control is the commonest; principal connections are shown in Fig. 1. The usual control arrangement is for phase-shifting, but with this some care is needed to avoid hunting under certain circumstances. Bias shift

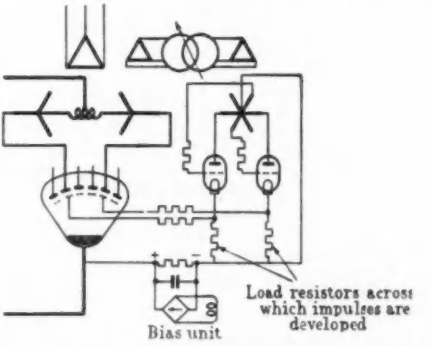


Fig. 2. Impulse control using a thyratron circuit

control is less frequently used. Both of these methods are satisfactory when automatic speed control is employed, providing that the total output can be obtained from a single rectifier bulb. In such a case small variations in output voltage, occurring as a result of slight changes in conditions, are corrected by the action of the automatic regulator.

If impulse control is used the whole range of possible ignition potentials is covered simultaneously and a constant firing delay angle ensured. Whenever several grid-controlled bulbs work in parallel, impulse control is essential. Fig. 2 shows a simple circuit using thyratrons. Some technical improvement is possible by replacing the thyratrons with a small grid-controlled rectifier bulb, but the first cost is greater. A further alternative is the use of peaking transformers; the use of filaments is then avoided.

Control

Arrangements for starting and stopping rectifier motors, and for overload protection are quite normal, the main contactor being in the d.c. circuit. For speed variation the phase-shifting induction regulators may be motorised; for inching with grid-controlled rectifiers the phase-shifter may be set at its lowest-speed position, or d.c. voltage may be reduced to zero and then suddenly raised.

It is possible to arrange that a constant armature terminal voltage is maintained, compensating for supply voltage variations; with the additional use of a tachometer-generator, a constant speed may be automatically ensured. Suitable circuits may be set up so that rapid switching from one controlled speed to another is possible. Reversing may be accomplished either by using contactors or by connecting two rectifiers in reverse parallel. The cross connection of rectifiers is likely to be superior if rapid reversals are required.

DISCUSSION

DR. A. L. WHITELY (B.T.H.) saying that he agreed with most of what the author had to say, suggested that the greatest factor in limiting the application of rectifier-motor drives was the existence of so many alternative forms. Only the glass bulb rectifier was mentioned in the paper, but the ignition single anode design had many applications. In general the rectifier drive was worth considering in some form or another, when a wide speed range was required, if speed control at 2%or better accuracy was wanted or if the basic controlling quantity was at a low power level.

Motor characteristics became relatively unimportant as drive limitations if feed back was employed ; only commutation and heating had to be watched.

MR. W. R. JONES (Nevelin Electric) also expressed himself as being generally in agreement with Mr. Bingley. He went on to discuss various points of detail in the paper, and then came to the question of power factor. This could be corrected by conventional means, using capacitors, but this was expensive and hardly necessary. He had found that the kVA input at full load and top speed was higher than at any other point in the working range. As it was this maximum kVA that determined the tariff charge, no correction was necessary from this aspect. At full speed the combined drive power factor was about 0·93.

Comparing rectifier drives with variable speed a.c. motors, he said that at low speeds the efficiency was little, if any, worse, while at high speeds it was undoubtedly better.

MR. C. F. FREEMAN (Courtaulds) added to the advantages of the rectifier drive which Dr. Whitely had listed, absence of a multiplicity of commutators (cp. Ward Leonard drive) and of the need for heavy foundations. Referring to the power factor problem, he said that throughout the whole working range, the kilovars remained substantially constant. He went on to suggest that designers sometimes asked for more information about driven loads than prospective users, however willing to co-operate, were able to give.

MR. S. DALE (G.E.C.) thought that the most important aspect of the power factor problem was that usually variable speed drive motors made up only a small proportion of the total factory load. Fear of harmonics has prevented many possible users from applying the rectifier-motor drive: most such fears were unnecessary. With respect to the risk of surges, due to rectifier working in cold weather, he asked if there was danger of damage to the motor.

MR. A. T. ROBERTSON (A. Reyrolle) mentioned that impulse control of rectifiers often gave excellent results, and that an advantage of this system was that removing the pulses shut down the rectifier.

MR. P. MCKEARNEY (Ministry of Works) described leading characteristics of a wind tunnel drive he had recently installed employing two 6,500 h.p. motors fed from steel tank rectifiers. Speed regulation of something better than 1% was expected from this installation, using grid control.

MR. H. P. BLAKE (Nevelin Electric) suggested that in many cases users of motors could measure speed accurately in terms of product: more accurately than would be possible with a tachometer. Referring to loads overrunning, with consequent danger of severe over-voltages, he said that this problem called for close co-operation between motor designer and rectifier designer. Dealing specifically with rectifiers, he referred to the proved advantages of introducing argon into the bulbs.

The AUTHOR replied briefly to many of the points made in the discussion. He deprecated some of the control suggestions made because they involved the introduction of electronics into the factory. Dealing with equipment sizes, he suggested that up to 240 kW could be handled by one bulb; after that parallel operation became necessary.

Troubles—and Remedies

A series* of trouble-shooting tables specially compiled to assist maintenance engineers in rapid fault diagnosis

No. 10. D.C. GENERATORS

By S. SPENCE, B.Sc.

D.C. GENERATORS are subject, in general, to many of the troubles which occur with d.c. motors, dealt with in a previous article in this series, since their construction is in most cases practically identical.

Roughly speaking, it may be taken that the same troubles in either bearings, and other mechanical items, or damage to or incorrect connection of windings, will have approximately the same effects on both generators and motors, although the symptoms may be different. D.C. generators are also more liable to commutator troubles which can develop from a variety of causes. In some cases the primary source of poor commutation may be somewhat obscure, and systematic investigation is then essential to ensure arriving at the correct solution of the problems. It should be borne in mind, however, that adherence to sound electrical engineering practice in the installation, operation and maintenance of such machines is the best insurance against serious troubles.

*Previous tables have appeared as follows: Induction Motors, June 15, 1950; Transformers, July 27, 1950; D.C. Motors, Nov. 9, 1950; Synchronous Motors, Jan. 4, 1951; Single-phase FHP Motors, March 1, 1951; A.C. Generators, May 17, 1951; Mercury Arc Rectifiers, July 26, 1951; Rotary Convertors, Oct. 4, 1951; Motor Starters and Switchgear, Nov. 8, 1951.

SYMPTOM	CAUSE	REMEDY
General overheating of frame.	Overloading	Reduce load or install larger machine. Rectify any external fault such as a short circuit on wiring or motor winding which may be responsible for overloading the generator.
	High ambient temperature.	Reduce by improving ventilation. Alternatively change location of machine.
	Adjacent source of heat.	Modify drive to enable machine to be removed from the path of the transmitted heat. Alternatively interpose a suitable protective barrier between the machine and the source of heat.
	Restricted internal ventilation of machine due to obstructing dust deposits in the generator ventilating ducts or in the screens of a forced ventilating system.	Dismantle machine or ventilating screens for cleaning as necessary. Adopt any practicable measures to prevent or reduce ingress of dust, etc., to interior.
General overheating of armature	Overloading.	Reduce the current load.
	General dampness with resultant seriously low insulation resistance.	Dry out the winding until a satisfactory insulation resistance reading is obtained.
Overheating of one or more individual coils in the armature	Short-circuited coil or coils. Open-circuited coil or coils.	Repair or re-wind the defective coils.
	Incorrect connections between coils and commutator segments, usually due to adjacent connections being crossed during repair or rewind.	Reconnect coils to correct segments.
Overheating of all the shunt field coils	Excessive current consumption due to:— (*a*) Short-circuited turns. (*b*) Not enough turns in the field winding which might result from an unsatisfactory repair. (*c*) Voltage too high.	 (*a*) Locate and repair the defective coil or coils. (*b*) Increase the number of turns or insert a suitable external resistance. (*c*) Reduce voltage to normal.
Overheating of one or more shunt field coils, the remaining coils being much cooler than normal	Excessive current in the hot coil or coils due to the remaining coils being completely short-circuited.	Locate and repair the short-circuit.

SYMPTOM	CAUSE	REMEDY
Overheating of series field coils	Excessive current due to:— (*a*) Short-circuited turns. (*b*) High current density.	(*a*) Locate and repair defective coil or coils. (*b*) Re-wind coil or coils with increased gauge of wire or increase the number of turns.
	General dampness with resultant seriously low insulation resistance.	Remove and dry out the coils, until a satisfactory insulation resistance value is obtained.
Overheating of commutator	Excessive brush friction and/or contact drop due to (*a*) Tarnishing and oxidation of commutator surface.	(*a*) Ingress of gases is a common source of this trouble and all practicable precautions should be taken to prevent injurious gases from coming into contact with the commutator.
	(*b*) Rough commutator surface.	(*b*) Turn or grind and polish to restore the commutator surface.
	(*c*) Excessive brush pressure.	(*c*) Reduce pressure by suitable adjustment of spring tension.
	(*d*) Wrong grade of brush.	(*d*) Consult the makers if necessary to confirm the correct grade.
	(*e*) Excessive current density.	(*e*) Check the brush current and if normal, consult the makers with regard to the recommended density for the correct type of brush.
	Inadequate means for heat dissipation.	This is fundamentally a problem for the designer of the machine. A reduction of the operating temperature, however, might be achieved by adopting any practicable measures for improving the ventilation of the commutator.
Hot bearing (all types)	Imperfect alignment of coupling or gear drive.	Re-align correctly.
	Driving belt too tight.	Reduce belt tension.
	Driving belt too far from bearing (due to excessive overhang of pulley).	Modify belt drive accordingly and if necessary fit an extra bearing to share belt load.
	Heat transferred from generator windings.	See causes of general overheating of frame.
	Adjacent source of heat.	
	High ambient temperature.	
Hot bearing (ball and roller)	Incorrect fit:— (*a*) Inner race too tight on shaft.	(*a*) Polish shaft and re-fit bearing, making race a tight press fit (an interference fit) to prevent "creep."
	(*b*) Outer race tight in end bracket.	(*b*) Polish end bracket housing as necessary to make bearing race a sliding fit on its seating.
	Too much grease.	Remove excess grease.
	Wrong grade of grease.	Replace by suitable grade recommended by the makers after due consideration of normal operating temperature conditions.
Hot bearing (ring oiled)	Diametric clearance too small.	Fit new bearing having larger clearance.
	Insufficient oil in well.	Top up oil level.
	Leakage of oil from well past drain plug or gauge glass.	Refit drain plug or gauge glass correctly.
	Oil well overflow pipe bent or displaced, thereby reducing oil level in well.	Refit pipe in correct position.
	Obstruction in overflow pipe.	Flush out and refill with oil.
	Oil ring stationary or sluggish in action due to:— (*a*) Ring tight in slot.	(*a*) Reduce width of ring and polish sides smooth.
	(*b*) Ring damaged.	(*b*) Repair or renew ring.
	(*c*) Foreign matter in oil.	(*c*) Clean oil.
	(*d*) Wrong grade of oil.	(*d*) Replace by suitable grade.
	(*e*) Bearing turned in housing due to set Screw becoming loose or defective, thereby displacing oil ring slot from normal position.	(*e*) Re-secure bearing in correct position.
	(*f*) Oil ring jumped out of slot.	(*f*) Fit retaining strip across top of slot.

SYMPTOM	CAUSE	REMEDY
Hot bearing (ring oiled) (contd.)	Bearing metal dust or other obstructions in bearing oil grooves.	Remove bearing for cleaning of grooves.
	Bearing oil grooves incorrectly cut.	Remove bearing and modify grooves, making sure they are correctly located, cut and backed off. The inside of the ring slots should also be backed off.
	Tight bearing.	Scrape bearing to correct fit.
	End thrust on bearing due to:— (*a*) Incorrect assembly. (*b*) Faulty drive.	 (*a*) Reassemble generator with armature in magnetic centre. (*b*) Modify drive as necessary to eliminate end thrust.
	Shaft out of true.	True shaft in lathe and renew bearings.
	Excessive overload.	Reduce the electrical load, or locate and remedy external fault.
Sparking at brushes	Brush vibration due to:— (*a*) Eccentric commutator. (*b*) Low bars or flats. (*c*) Rough or grooved commutator.	 (*a, b, c*) True the commutator by turning or grinding and polishing. It is preferable to do this with the armature in its own bearings, and the armature windings must, of course, be carefully protected to prevent the ingress of dust or turnings. If the edges of the bars have dragged over the mica sections, the latter should be carefully scraped and where the mica is recessed, the edges of the bars should be slightly bevelled. For grooving of commutator see Note 1.
	(*d*) Distorted commutator. (*e*) High bars.	(*d, e*) Re-season the commutator. This process comprises heating the commutator uniformly to a temperature of about 100° C, followed by running it at full speed and then tightening up the commutator bolts as necessary whilst the commutator is still hot, and finally re-grinding. The treatment should be repeated as necessary until the commutator has finally settled down.
	(*f*) Excessive clearance in brush holders.	(*f*) Change brushes or holders after ascertaining which are incorrectly dimensioned, to obtain correct fit.
	(*g*) High micas.	(*g*) Reduce the mica sections slightly below the level of the commutator bars.
	(*h*) Unbalanced commutator.	(*h*) Dynamically balance the armature at its normal speed.
	(*i*) General vibration with an external source.	(*i*) Locate and remedy the cause of vibration, e.g. defective drive.
	Inadequate clearance in brush-holders.	Adjust the brushes to ensure that they slide easily in their holders.
	Imperfect bedding.	Re-bed the brushes correctly to the commutator surface, to ensure that the full area of the brush face makes contact.
	Incorrect brush position.	Move the brush arm assembly forward (in the direction of rotation) to improve the commutation. If necessary, check the neutral position of the brushes. (See Note 2).
	Incorrect brush pressure.	The pressure must be uniform to prevent unequal distribution of current between the brushes, whilst too little pressure has the same adverse effect due to the resulting brush vibration. (See Note 3).
	Incorrect spacing of brushes (with resultant circulating currents).	Check the spacing around the commutator by actual linear measurement between brushes on adjacent arms, which should give exact uniformity. Inaccurate spacing may be due to shrinkage and displacement of insulation from brush arms, faulty construction or incorrectly assembled boxes. Any such defects located should be suitably remedied to equalise the spacing.

SYMPTOM	CAUSE	REMEDY
Sparking at brushes (contd.)	Unsuitable grade of brush.	The same grade of brush as was originally supplied should always be used unless an alternative recommendation is approved by the makers. It is bad practice to use different grades of brush simultaneously, and if, in cases of emergency, odd brushes are used they should be uniformly distributed on brush arms of the same polarity.
	Unequal air gaps due to:— (*a*) Worn bearings. (*b*) Incorrectly mounted poles, which may be the result of faulty re-assembly after overhaul or repair.	Equalise the air gaps by:— (*a*) Endshield adjusting screws if provided, or renewal of excessively worn bearings. (*b*) Correcting the radial position of the pole shoes.
	Incorrect pole spacing due to inaccurately mounted pole pieces.	Equalise pole spacing by correcting assembly.
	Open circuit, short circuit, or defective joint in armature.	Evidence of open-circuits and short-circuits in the armature is usually to be found at the commutator bar connected to the faulty coil, where burning of the copper and mica takes place. Defective joints can generally be located by the signs of solder thrown from the connection of the armature coils to their respective commutator bars. More elusive faults can be traced by carrying out a drop test (see Note 4).
	Short circuits between adjacent commutator segments.	Surface shorts due to oil, dust or other foreign matter on the mica sections can usually be removed by scraping the mica until it appears white. But if a mica section is deeply burnt or otherwise damaged it will require renewing and this will necessitate partial dismantling of the commutator. The potential drop test described in Note 4 can be used to locate short-circuited commutator bars, and as such shorts may result in the commutator joints becoming unsoldered any defective joints should be re-made.
	Brush arms and interconnectors having unequal resistances, with resultant unequal current distribution in the arms.	Remove and overhaul all leads and brush terminal contact faces with a view to eliminating any points of high resistance, due to tarnished or otherwise defective contact.
	Defective main field or interpole winding.	Locate and repair any defect such as a short circuit or earth fault, which by spoiling the magnetic symmetry has the same effect as unequal air gaps. A short-circuit may be detected by measuring the voltage drop across each coil. All readings should, of course, be equal, and as previously mentioned, a completely short-circuited coil will be much cooler than the rest.
	Commutating poles reversed.	Check the polarity of the poles with a compass needle. (See Note 5.) Reverse any incorrectly-connected coils. Reverse the connections to any individual coils of wrong polarity.
	Commutating pole strength incorrect.	If the suitability of the commutating pole winding is in doubt, brush potential curves should be taken. (See Note 6.)
	Defective equaliser connections in parallel wound armatures, resulting in circulating currents passing through the brushes.	Repair defective connections.
	Absence of, or inadequate number of, equaliser connections.	Consider the desirability of fitting or increasing the number of equalisers and consult the makers in the case of a new machine.
Blackening of individual commutator bars	Short-circuit or open-circuit in armature.	Locate and repair defect.
Generator fails to generate	Excitation circuit broken due to open circuit in field winding, interconnecting leads or field regulator.	Locate and repair the break.

SYMPTOM	CAUSE	REMEDY
Generator fails to generate (contd.)	Excessive resistance in the shunt field circuit due to defective joints, terminal connections, regulator contacts, etc.	Trace and repair the defect.
	Short-circuits in the field coils or leads, or earth faults or shorts between field and main circuit windings, with resultant cutting out of circuit of a large portion of the field winding.	Locate and repair the defective portion of the windings or leads.
	Residual magnetism lost.	Disconnect the field winding leads and separately excite the field winding only from an external source such as a battery, for a few minutes. Then reconnect the generator normally and check its polarity. (See Note 7.)
	Field winding of self-excited generator reversed.	Reverse the connections to the field winding and run the machine above its rated speed. If necessary, short-circuit the armature to cause the excitation to build up. (See Note 8.)
	Individual field coil or coils reversed.	Correct the connections and confirm by checking the polarity of the poles.
	Field regulator wrongly connected with resultant inadequate excitation.	Re-connect to obtain correct regulation.
	Open circuit or short circuit in armature winding.	Locate and repair the fault. (See Note 4 for Drop Test.)
	External short-circuit. In this case the generator may try to build up, with heavy sparking at the brushes, particularly if these are displaced backwards.	Bring the generator to rest immediately, locate and rectify the external fault.
	Commutator segments short-circuited.	(See Note 4.) See remedy under "Sparking at brushes."
	Excessive contact resistance at commutator due to:— (*a*) Dirty or tarnished commutator. (*b*) Insufficient brush pressure.	 (*a*) Clean and polish the commutator surface. (*b*) Increase the brush spring tension.
	Wrong brush position which may be due to incorrect re-assembly of brush gear after overhaul or repair.	Re-set the brushes in the correct position. (See Note 2, method of finding the neutral position.)
	Direction of rotation reversed.	Reverse direction of rotation or reverse the connections of the field winding. (In the case of a compound generator, reverse one winding only.)
Voltage too high	Generator speed too high.	Reduce the speed to normal and remedy any defect such as a faulty governor which may be responsible for the trouble.
	Excitation too strong.	Reduce by inserting more resistance in the field circuit.
Voltage too low	Generator speed too low.	Increase the speed to normal and remedy any defect in the drive such as slipping belts or a faulty governor which may be responsible for the trouble.
	Excitation too weak due to:— (*a*) Too much resistance in excitation circuit. (*b*) Reversed field coil or coils.	 (*a*) Cut out more resistance by means of regulator or remedy any defects such as bad contacts in the regulator, faulty terminal connections, etc. (*b*) Re-connect coil or coils correctly.
	Individual coil or coils short-circuited.	Repair the faulty coil or coils.
	Incorrect connection of the field winding such as two parallel circuits wrongly connected in series after repair or overhaul.	Re-connect the winding correctly.
	Wrong brush position.	Re-set brushes correctly.
	Air gap too large, which may be due to incorrect assembly after repair or overhaul.	Re-assemble poles correctly.
	Generator overloaded.	Reduce the load.

SYMPTOM	CAUSE	REMEDY
Excessive voltage fluctuations	Fluctuating speed of driving machine.	Rectify the trouble in the driving machine, such as defective governor, or transmission gear (slipping belts, etc.) or defective motor.
	Inadequate or reversed compound winding.	Increase the number of turns or reverse the winding connections as necessary.
Excessive current fluctuations	Defective transmission gear or governor.	Rectify defect such as slipping belts, etc.
	Intermittent open circuit or defective contact or connection in the excitation circuit.	Trace and repair defect.
Unsatisfactory load sharing of generators in parallel	Machines having different voltage variations between no load and full load.	Adjust brushgear position. (See Note 9.)
	Defective contacts or connections in excitation circuit.	Locate and remedy defect.
Unstable operation of compound generators in parallel	Absence of, or incorrect connection of equalising circuit.	(See Note 10.)

NOTES

Note 1. **Commutator grooving.**—A common expedient for preventing grooving of the commutator is axial staggering of the brushes, and in this connection alternate pairs of brush arms should be staggered to reduce the tendency for "copper picking" at the brush contact faces. See Fig. 1.

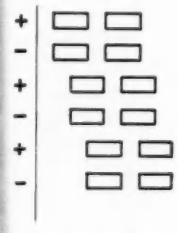


Fig. 1.—Correct method of staggering brushes

Note 2. **"Kick" test.**—With the machine at rest and the armature open circuited, supply the main field winding from an external source with a current of about 25% of its normal value. Connect a low-reading voltmeter between two adjacent brush arms to register the induced voltage obtained when the field circuit is quickly opened or closed. Rock the brushes until a minimum value of the voltmeter reading is obtained, this being the neutral position. It is advisable, however, to repeat the test with the armature in two or three different positions, and adopt the mean of the neutral positions so found.

Note 3. **Brush pressures.**—The following values may be taken as a general guide:

Carbon and graphite brushes. Pressures between 1½ and 2 lb per square inch for ordinary purposes. But it may be necessary to increase the value to 2½ or 3 lb per square inch in special cases. Higher pressures still are required for machines subjected to vibration.

Metal-graphite brushes. Correspondingly higher pressures are recommended, the minimum values for ordinary purposes being from 2½ to 3 lb per square inch.

Note 4. **Drop test.**—More elusive faults can be located by carrying out a bar-to-bar potential drop test round the commutator. With current from an external source passing through the armature at rest, the potential difference between consecutive bars is measured by means of a low-reading voltmeter. If the armature is sound, identical readings will be obtained between adjacent bars all round the commutator, whereas an open circuit or defective joint will result in a high voltmeter reading, and a short circuit will be indicated by an abnormally low voltmeter reading.

Note 5. **Interpole polarity.**—The correct sequence is as shown in Fig. 2 for both generators and motors.

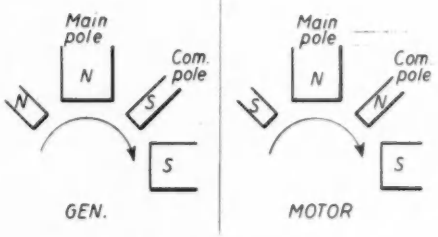


Fig. 2.—Interpole polarity

Note 6. **Brush Potential Curves.**—Connect one terminal of a low-reading voltmeter to the brush terminal and place the lead from the other voltmeter terminal in contact with the commutator at a number of equidistant points "under" the brush. (See Fig. 3.) The nature of the com-

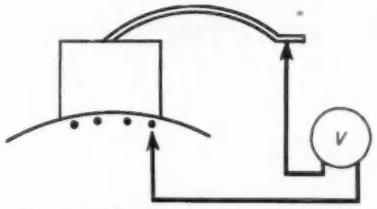


Fig. 3.—Taking brush potential curves

mutation can then be assessed by plotting curves of potential from the readings obtained at consecutive positions under the brush. (See Fig. 4.)

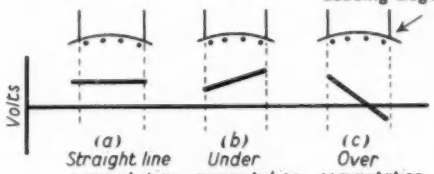


Fig. 4.—Interpretation of brush potential curves

The maker's advice should be sought regarding any proposed modification of the winding.

Note 7. Where a shunt generator is one of several connected to the same busbars, the field can be energised from the bars by closing the main switches after raising the brushes or otherwise isolating the armature. A suitable resistance should be connected across the field circuit to prevent an excessive voltage rise on opening the main switches. In the case of compound wound generators with equaliser connections, closing the equaliser switch and associated busbar switch will energise the series field in the correct direction.

Note 8. Compound wound generators supplying a motor load should never be brought to rest with the motors still connected, as in the event of the generator coming to rest before the motors, the latter would act as generators and by passing a current through the series field of the generator in the reverse direction would effect a reversal of the polarity.

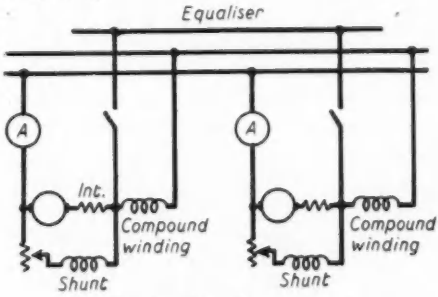


Fig. 5.—Equaliser Connections for Compound Machines

Note 9. If difficulty is experienced in adjusting the load sharing by hand operated field regulators, adjustment of the voltage variation can be effected by suitable displacement of the brush rocker. Forward displacement increases and backward displacement decreases the voltage drop. The amount of displacement possible is, of course, limited by its effect on commutation. If automatic proportional distribution of load is required without varying the excitation, it is essential that the generators have the same voltage variation and their driving machines the same speed drop from no load to full load.

Note 10. For stable operation of compound generators in parallel it is essential that an equalising connection be made between the compound winding as shown in Fig. 5. It is also important that the ammeter should not be in the lead from the busbar to the compound winding as such an arrangement with an equalising current flowing in the equaliser circuit would give a wrong indication of the load current distribution.

CABLES OVER MALVERN HILLS

THE claim by the National Trust for an injunction restraining the Midlands Electricity Board from erecting an overhead cable on a 500-yard stretch over the Malvern Hills was dismissed by Mr. Justice Vaisey in the High Court of Justice on Monday.

In addition to the injunction, the Trust also sought, as against the board and the Church Commissioners, a declaration that they were entitled to enforce restrictive covenants, contained in a deed of 1936, in respect of land belonging to the commissioners at Castlemorton Common, Shady Bank Common, and Holly Bed Common, Worcestershire. It also asked for a mandatory order on the board, if necessary, to pull down and remove certain poles and cables.

For the Trust, it was contended that although the proposed supply line did not cross the property owned by the Trust it crossed adjoining property belonging to the Church Commissioners over which the Trust had restrictive covenants. The Trust was seeking to enforce these covenants.

It was emphasised that the action was regarded as of great importance to all electricity boards, for if it were the law that their statutory powers with regard to wayleaves were liable to be overridden by private rights it would have extraordinary results.

Giving judgment, Mr. Justice Vaisey said he thought that the matter rested on the wording of one restrictive covenant of the deed of 1936, the wordage of which was extremely inapt and ill conceived. The covenant was void for uncertainty. If he were wrong the question arose whether the Electricity Board had acted within their statutory power thereby being relieved from their obligations to observe the restrictions. His Lordship said he must answer that question in the affirmative. The action was dismissed with costs.

Water in Transformers

Recent E.R.A. review of effects on oil

ONE of the E.R.A. Reports among recent issues is of wide interest to the electrical industry. This, "The Causes and Effects of Water in Oil-immersed Transformers," by M. R. Dickson, price 9s., goes far to placing this troublesome subject on a rational basis.

The presence of water in an oil-immersed transformer is generally, and rightly, regarded with disfavour. It is not, however, right to suppose that a transformer necessarily gives any trouble even when large quantities of water are present. The Report deals with this apparent anomaly.

Causes of Water in Transformers

Introducing the main subject, the Report first of all analyses the causes of water being present in transformers. Three possible causes are considered; first, by leakage of water into the tank from outside; second, by chemical reaction within the oil, and third, by absorption of water vapour from the atmosphere. Of these, the first is not dealt with, except to mention that when free water is found in the tank the probability is that it is due to leakage from outside. The second and third causes are, however, covered at considerable length.

Chemical formation of water is an elaborate and complex matter. Transformer oil, excluded from all contact with oxygen or air is stable for an indefinite period at temperatures normally found in transformers. It is, however, liable to oxidation if oxygen is available, and one of the products of this direct oxidation is water. Other products include acids and sludges. It is also well established that heavy metals immersed in oil act as catalysts. Part of this action may be a surface catalysis, but there is evidence that it appears to be mostly a chemical reaction. The organic acids, produced by the direct oxidation of the oil, react with the heavy metals, forming compounds such as metal soaps, which in turn dissolve in the oil and act as very effective catalysts in both the formation and decomposition of hydroperoxides. Thus the oxidation rate is speeded up until a certain concentration of catalysts is reached when it proceeds at a constant rate.

The speed of oxidation increases rapidly with temperature, an increase of 10° C doubling or trebling the reaction rate: thus effective oil cooling is essential to prevent rapid deterioration. Certain substances, mainly phenolic or nitrogenous compounds when added to the oil had an inhibiting effect, but after they had been used up oxidation proceeded at its normal rate.

An estimation is given in the Report of the quantity of water formed by this means, which is far from inconsiderable.

It was possible for water contained in the air to be deposited as water on the free surface of the oil. This was largely dependent on atmospheric conditions when the metal of the tank fell below the dew point of the air contained within the tank. Some improvement could be made by ventilating the air above the oil, or, alternatively, by having the lid made airtight so that only a definite amount of water could be trapped in the internal air. Another method was to fill the whole of the space within the tank with oil, and this was adopted in conservator-type transformers.

Effects of Water in Transformers

The oil in a transformer has to fulfil two functions, that of removing heat from the windings, and that of maintaining the insulation of the windings. The first of these functions is generally unaffected by the presence of moisture. The breakdown voltage (B.D.V.), however, of the oil is lowered by dissolved moisture. Most deterioration of B.D.V. occurs with the addition of very small quantities o impurities, and information is given in the Report as to the extent of this deterioration with various types of adulterant.

From the operating point of view the resistivity of an oil in a transformer is of practically no importance, although this is not so in cables or capacitors. The resistivity does, however, enable an estimation to be made of the condition of the oil, and in this connection, particular attention should be paid to the temperature at which measurements are carried out.

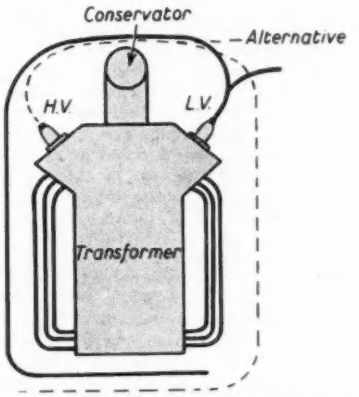
Important effects of water, however, are in its action on insulation. Most paper and other absorbant types will readily take in available water, and can be seriously damaged both physically and electrically, the latter leading to tracking, breakdown or electrolysis. Water vapour in the space above the oil can lead to corrosion of steelwork and possibly attack on non-ferrous metals. These latter phenomena are under investigation and will be presented in a further Report.

Problems and Practice

IN ENGINEERING

Transformer Cable Connections

AN alternative to the use of the more general type cable boxes is the employment of brass glands, which enable the cables to be taken direct to the transformer tank and wiped direct on to the glands. The glands can be arranged for the cables to be taken out at



Alternative arrangements for cable connections

almost any angle which is very helpful in many situations. Should the cables be required to run underground, it is possible to loop the higher and lower voltage cables overhead in such a way that syphoning of oil into the cables is entirely eliminated. Non-bleeding cables are used with these glands, and all glands are insulated from the transformer tank. Terminating pre-impregnated paper cable directly into the tank eliminates an extra chamber or box. This method can be used on almost all sizes of transformer units provided the cable tails are sealed with silk tape.—*MICE.*

Testing Interpole Polarity

ON occasions the maintenance engineer may be faced with the problem of ascertaining the interpole polarity (relative to the armature) of a d.c. machine. Although there are various methods of finding this the writer can personally recommend the following, it possesses the advantage of needing very little apparatus. The armature and interpole windings are connected in series and the brush rocker moved round until the brushes are in a direct line with the centre of the interpole shoe. The main field is disconnected, also all load removed from the motor. The motor should now be connected to a source of current of about 25 per cent. normal voltage. It may be necessary to insert additional resistance in circuit if the starter is not suitable. If the interpole polarity is correct the armature will rotate in the same direction as that in which the brush rocker was moved. If this is not so the two main leads to the brushgear should be reversed. The brushgear should next be returned to its original position, and the main field reconnected. If it is found upon starting up that the direction of rotation is opposite to that desired, this can be corrected in the usual way. It must, however, be remembered, that in doing this the armature and interpole windings must be treated as one unit if it should be decided to reverse the direction of current through the armature.—*W.H.*

A Breakdown Experience

A COMPOUND interpole 120 h.p. 500 volt haulage motor had been giving trouble for days by heavy sparking from one set of brushes. The question of easy inspection had received little attention from the haulage manufacturers as the haulage bed had been built round the motor. However, brush position was in order, and the motor was put to work again with slightly increased brush tension. Sparking being as bad as ever, the motor was again examined at the first opportunity and this time the trouble was found. The heavy copper strap connecting one pair of brush arms was found to be fractured just against the connecting tab clamped under the lower of the pair of brush arms. With some difficulty a new strap was made and fitted, and the motor ran without any trouble for several months when the trouble reappeared, the other connecting strap having broken in much the same position. The motor being subject to a lot of vibration, it was decided that single-piece copper connecting straps were too rigid, and therefore straps were made up composed of three strips, the total cross sectional area being equal to the old straps. The new straps were lightly taped and varnished and after fitting no further trouble was experienced.—*F. R. S.*

Servo-Mechanisms

A Method of Obtaining Simultaneous Coarse and Fine Corrections

THE problem of obtaining fine and coarse correction of high-precision position-control servo-mechanisms is one which has several possible solutions. At the present time, the majority of servo-mechanisms operate initially on a coarse system to bring the error within the range of the fine system and then change over to the latter to obtain high accuracy. This involves three different time sequences, the first when the coarse is operating, the switchover period, and the final response time when the fine error is controlling.

A method whereby both corrections could operate simultaneously was described by Mr. J. C. West at an I.E.E. Measurements Section Meeting last Tuesday. The system adopted is shown in the schematic diagram below. It can be seen that this consists essentially of all the normal components of a remote-position control servo-mechanism. The fine error signal, derived from a geared drive, is, however, fed to the amplifier through an integrator. Thus, in fact, signals from the fine channel become of importance only after a fine error has existed for some time. If this integrator was not present and the coarse and fine signals were simply added, there would be points where the coarse error, being of opposite sign to the fine error would cancel each other, giving a series of spurious zeros. With the circuit shown, however, when the system begins to operate, the integrator wipes out to a large extent the fine error system, and only when the fine error signals become of comparatively long duration (i.e., when the system is near the final rest point) does the fine error channel take control.

The paper continued by describing the experimental equipment used in this investigation, and gave details of the circuits used and the results obtained. Theoretical analysis of the error, of the effect of the integrator on stability and of the final accuracy, were also included.

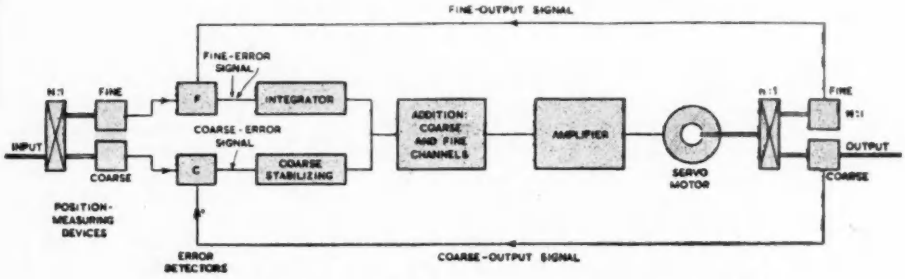
DISCUSSION

MR. D. BEST (Ferranti, Ltd.) thought the device useful, but the case overstated. Mr. West had given four disadvantages of the relay change-over system. First, he said, the response to a large displacement might be slow. Mr. Best could not see where the proposed system was any better. Secondly, a disadvantage claimed was that the change-over system had to be analysed in two parts; whereupon Mr. West proposed a system which could not be analysed at all. The third disadvantage—that of having a relay at all—was valid—but the fourth disadvantage, that the coarse and fine systems had to be stabilised separately, was not, in Mr. Best's opinion, a disadvantage at all.

MR. P. G. BRIGGS (Elliott Bros., Ltd.) congratulated Mr. West on an essentially practical paper dealing with what had been an awkward problem for servo engineers. He claimed that there were at least two alternative methods of using integrators to achieve simultaneous coarse-fine channel system, and demonstrated one with the use of a slide. Furthermore, it did not seem essential to him to use an integrator in the system, although it was essential to use a higher gain on the fine channel. He thought Mr. West over-emphasised the necessity for the integrator, which was, in fact, a convenient way of doing the job.

MR. G. BISHOP, dealing with Mr. West's paper, questioned how accurate the method could be if the coarse signal was used.

MR. WEST briefly replied to the points raised.



This schematic diagram shows the general system adopted experimentally

Self-excited Induction Generator

New Design Provides Power Factor Control

THE use of induction generators for private generating plant in factories using large quantities of process steam, has frequently been advocated, and there are at present some of these installations operating in this country. The prior use of process steam for generation purposes can provide a relatively cheap source of power up to the capacity and availability of the process requirements. In very large plants, this is frequently carried out by using pass-out or back-pressure turbo-alternators, but in smaller plants a cheaper and more easily operated method is to use a steam-driven induction generator. In general, in these cases, only part of the factory's electrical requirements can be generated privately, and a consequent problem is to obtain an automatic balance between this and the "imported" power. This becomes even more difficult when steam demands are fluctuating in nature.

The main objection to the use of a small synchronous d.c. excited generator is raised by the supply authority who usually dislike the possible reaction on the mains of faulty synchronising. The induction generator obviates this, as it can be run up as a motor by any of the usual methods, and brought up to generating speed by its prime mover: voltage and frequency are then inherently tied to those of the mains.

Hitherto, however, induction generators have certain disadvantages. Within the capacity of the machine, the power generated is roughly proportional to the amount of positive slip, full load being attained at about 3% above synchronism. When generating, the machine takes all its wattless components from the mains, and thus gives an undesirable loading to the mains. The introduction of power-factor correction capacitors, although practicable, involves more undesirable complications. A further disadvantage is that in the event of mains failure or power cuts, the excitation to the machine is cut off and the generator cannot work.

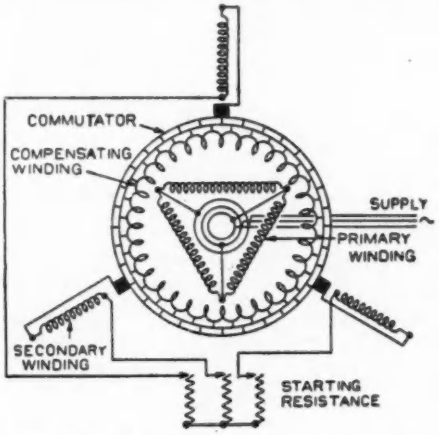


Fig. 1. Schematic circuit of a compensated induction motor to show windings and connections

M.-V. Compensated Generator

For the reasons given above a new approach to induction generation was required if the parallel running of two supplies was to be obtained without serious disadvantages. A solution was found in the use of the compensated induction generator.

The use of the compensated motor for p.f. improvement has been accepted for many years. A diagram of one of these motors is shown in Fig. 1. They usually have the primary winding on the rotor (fed by slip-rings) and the secondary on the stator. The rotor also carries an independent compensating winding which is connected to a commutator. Brushes on the latter connect this compensating winding in series with the stator winding. The injection into the stator winding of the compensating winding voltage changes the phase of the primary current, so improving the power factor to unity or leading. Moving the brushes round the commutator allows the amount of correction to be controlled, and at any brush position the wattless kVA provided is virtually constant over a wide range of load. When running as a motor, wattful power, corresponding to the load, will be taken from the supply and the machine will supply its own excitation, and additional kVA if desired for some correction of the system power factor.

When driven at a suitably increased speed, the compensated machine will generate in the same way as ordinary slip-ring and squirrel-cage types. Since, however, it is self-exciting, it can operate quite independently of the supply mains, and if it is run in parallel with them it will generate automatically in proportion to the process steam demand, but without requiring the wattless power taken by the usual type of

induction generator. In fact, under these conditions it will provide a controllable amount of reactive kVA and thus improve the p.f. of the load on the supply mains.

A Pioneer Installation

The first application of this system was carried out using Metropolitan-Vickers equipment in connection with the modernisation of the Firth Mills of Mark Nutter, Ltd., Skipton,

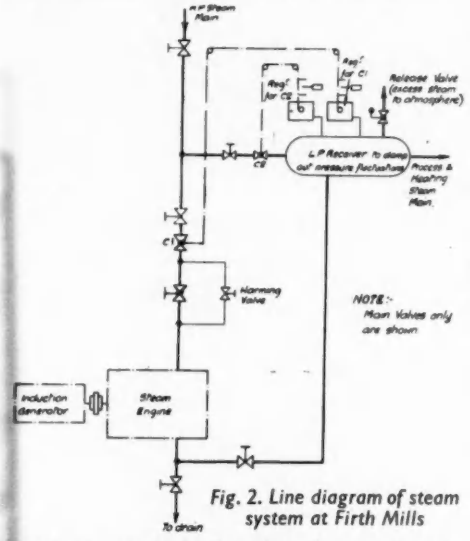


Fig. 2. Line diagram of steam system at Firth Mills

when it was decided to introduce up-to-date air-conditioning plant in the weaving sheds. This increased the demand for process steam, and to ensure full economic exploitation, it was decided to install a 100 kW compensated induction generator complete with auxiliary equipment. The installation was designed to have the following features: (a) it should be simple to start and operate so that it could safely be left unattended for long periods; (b) it should be capable of operating either independently or in parallel with the mains (or with a traditional type private plant); (c) it should be able to deal with a fluctuating steam demand that might exceed the capacity of the engine; (d) it should be suitable for starting up and running such motors as would normally be supplied, with the generator self-excited, and (e) it should be an economic proposition for the restricted period of each year during which sufficient steam to run the set was available due to the process demand.

Plant Description

The set consists of a 100 kW 500 r.p.m. Metrovick generator type CPT 98 driven by a Belliss and Morcom back-pressure steam engine of the two-cylinder compound type. The governor range of this engine was designed by the makers to the consultants' specification to meet the required conditions when running either under servo control or with straight line governing; it is self-governing during automatic operation, the governor acting purely as an overspeed safety device. The engine and flywheel are direct-coupled to the generator, via a Wellman-Bibby type coupling, the whole being mounted on a combined baseplate. The engine operates with steam at 150 p.s.i.g. 525° F., and exhausts into a small low-pressure steam receiver at 5 p.s.i.g.

A schematic diagram of the steam equipment is shown in Fig. 2. The "economic" rating of 100 kW is based on a steam demand of 2,800 lb/hr for optimum operating efficiency; of this steam demand, process requirements may amount to 1,000 lb/hr, the rest being taken for humidifying and heating purposes. A demand less than 600 lb/hr does not justify running the set, and demands above 2,800 lb/hr are automatically made up through a reducing valve direct to the low pressure steam receiver.

The pressure in the steam receiver is kept

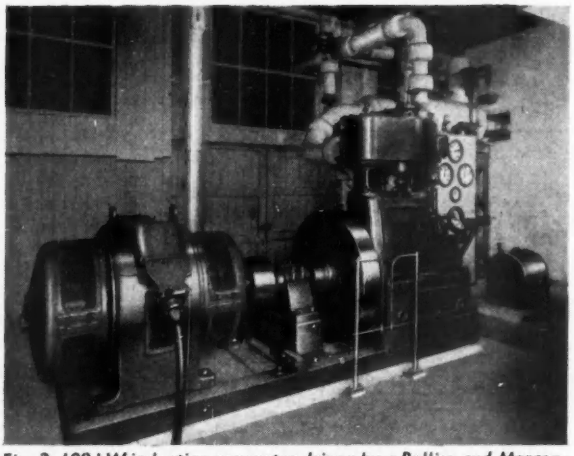


Fig. 3. 100 kW induction generator driven by a Belliss and Morcom reciprocating engine exhausting at 5 lbs per sq inch pressure to give process steam

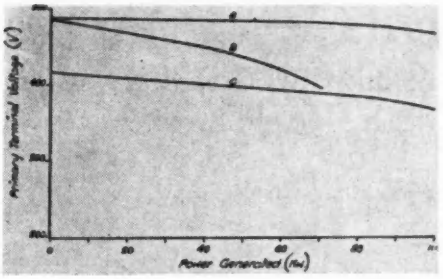


Fig. 4. Voltage regulation curves for 100 kW set. (a) Brush setting 220°, load p.f., unity. (b) Brush setting 220°, load p.f., 0.866 lag. (c) Brush setting 200°, load p.f., unity.

within very close limits by two Carlstadt automatic regulators made by Hopkinsons Ltd., of Huddersfield. The regulator cylinder is connected at one end to the low pressure steam receiver, and at the opposite end is a diaphragm or bellows carrying contacts. Changes of pressure cause the diaphragm to move, until at a predetermined value a central contact touches a side contact. This completes a circuit, which causes a small geared-motor unit on the regulator to operate, winding in or out a steel cable passing over pulleys to a valve in the h.p. steam main. Thus more or less steam is admitted as required. A limit switch, operated by stops on the steel cable, prevents over-travel of the valve in either direction.

Electrical Details

The set is arranged for normal running in parallel either with the supply authorities' mains, or with a 300 kW synchronous alternator driven by the main steam engine: it can also be used independently to supply essential services and lighting. When the two sets are running in parallel a reverse power relay prevents the 300 kW set from being motored; the relay is set to trip the circuit-breaker controlling the induction generator as soon as the total load on the private busbars falls below 100 kW (or at a proportionately smaller load with a lower steam demand). An alternative scheme can be provided to avoid the necessity of tripping the induction generator from the bars under such conditions. The kVA output from the 100 kW set is limited by an overcurrent relay which opens the feed to the geared motor unit of the Carlstadt regulator when the current exceeds a predetermined value.

Before starting the engine the selector-isolating switch is closed. Interlocking arrangements ensure that the engine warming valve must be fully open, the main steam valve closed, and the liquid (secondary circuit) starter in the off position, before the main o.c.b. for the induction generator can be closed. The operator thus opens the warming valve first, allowing the engine to run up to a speed slightly below normal. With the engine governor set for paralleling, the generator is started just like a slip-ring motor. After closing the circuit-breaker, the liquid starter is operated to complete the secondary circuit and all resistance is cut out. With the set now motoring, the main steam valve is opened, the warming valve being closed. The engine speed is then brought up under governor control until the machine starts generating and the automatic regulators become effective. Further operation of the governor to its upper limit leaves the set running at the speed and load determined by the l.p. steam demand. Experience has shown that the set can be paralleled on to either private or public busbars without taking more than 6 kW.

Running Characteristics

When running, the set is controlled by the two Carlstadt regulators, C1 and C2 (Fig. 2). For steam demands up to 2,800 lb/hr, the regulator C1, set for 5 lb/sq in. gauge in the l.p. receiver, controls the h.p. flow to the engine. When the pressure drops to 4·5 lb/sq in. gauge, regulator C2 comes into operation. The make up valve is used either when the set is not running, or if the steam demand exceeds the full steam load of the engine. If the electrical demand is greater than the steam demand, the atmospheric valve on the l.p. receiver allows steam to pass out when the pressure exceeds 5·5 lb/sq in. gauge.

Normally the brush-gear is set to give unity p.f. or slight over-excitation, although the amount of wattless kVA provided when running in parallel can be controlled by manual adjustment of the brush position.

Operating experience has been most satisfactory, and although the set is normally shut down for about four months in the year, when the steam demand is insufficient for economical operation, the amount of electricity generated to date averages over 70,000 kWh/annum.

The new system affords a very adaptable and ready means of floating electrically a process and/or heating steam demand on busbars normally fed from either public or private generating plant. With operation in conjunction with one supply only, the switching and protective arrangements are uncomplicated.

Our thanks are due to Metropolitan-Vickers for the information contained in the above article.

Non-Linear Systems

A Method of Solution By Graphical Analysis

LAST Tuesday, Prof. M. G. Say, on behalf of Miss Pei-Su Hsia, read her paper on "A Graphical Analysis for Non-Linear Systems." In introducing the subject generally, the paper explained that a physical system was

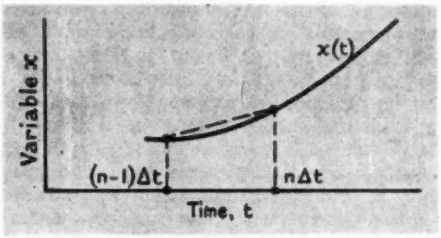


Fig. 1. Geometrical representation of eqn. (3)

said to be linear if the behaviour of its elements could be represented by an algebraic differential equation of the first degree. A system was, however, non linear if its equation contained the dependent variables, their derivatives or their integrals to powers higher than the first, or if it contained them transcendentally.

Strictly, all systems were non-linear, although many could be considered as linear as approximations or under working conditions. In some cases, however, non-linearity could not be ignored. For example, when a neon tube (with a non-linear voltage-current characteristic) was connected in parallel with a capacitor across a source of direct voltage, through a suitable linear resistor, the voltage across the condenser might pulsate. Several other examples existed in mechanical systems.

A large field of practical non-linear systems could be represented by the equation.

$$\frac{d^2x}{dt^2}+f(x)\frac{dx}{dt}+g(x)=h(t) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Integrating eqn. (1) with respect to t from 0 to t leads to

$$\frac{dx}{dt}+F(x)+\int_0^t g(x)dt=H(t)+K \quad \ldots\ldots\ldots\ldots (2)$$

where $F(x)=\int_0^x f(x)dx$, $H(t)=\int_0^t h(t)dt$

and K is the integration constant. Let $\triangle x$ be the increment of $x(t)$ for a small time interval $\triangle t$, and let x_n be the value of x at $t=n\triangle t$. With $\triangle t$ sufficiently small, write, for the instant $n\triangle t$,

$$\frac{dx}{dt}=\frac{(x_n-x_{n-1})}{\triangle t}=\frac{\triangle x_n}{\triangle t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

and $\int_0^t g(x)dt-K=S_n(t)$

$$=2\sum_{m=1}^{l} g(x_{2m-1})\triangle t + \tfrac{1}{2}[1+(-1)^{n+1}]g(x_{n-1})\triangle t-K \quad \ldots (4)$$

where $l=\frac{1}{2}n$ when n is even and $\frac{1}{2}(n-1)$ when n is odd.

Eqns. (3) and (4) are geometrically represented in Figs. 1 and 2 respectively. The derivative dx/dt at $t=n\triangle t$ is replaced by the slope of the line joining the points $[x_{n-1}, (n-1)\triangle t]$ and $(x_n, n\triangle t)$. The integrals

$$\int_{2(m-1)\triangle t}^{2m\triangle t} g(x)dt \ (m=1, 2, \ldots l)$$

and $$\int_{(n-1)\triangle t}^{n\triangle t} g(x)dt \ (n \text{ odd})$$

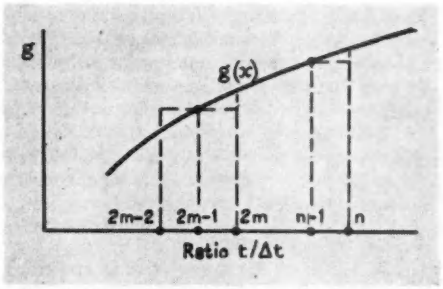


Fig. 2. Geometrical representation of eqn. (4)

are replaced, respectively, by the rectangle $2g(x_{2m-1})\triangle t$ and $g(x_{n-1})\triangle t$. Eqn. (2) thus becomes, for the instant $n\triangle t$,

$$\triangle x_n \tan\alpha+F(x_n)+S_n(t)=H(n\triangle t) \quad \ldots\ldots\ldots (5)$$

where $\alpha=\arctan(1/\triangle t)$.

From eqn. (5), for given values of $\triangle t$, x_{n-1}, and $S_n(t)$, a graphical solution for $\triangle x_n$ can be obtained. The solution for x_n is then the approximate solution of eqn. (2) when $t=n\triangle t$.

The process of graphical construction is shown in Fig. 3, and is as follows:—

Draw $F(x)$

Mark point A on the abscissa so that $OA=x_{n-1}$

Draw AB parallel to the ordinate axis.

Let $AB=H(n\triangle t)$ and let $BC=S_n(t)$

From C draw CD at an angle α to the abscissa, to intersect $F(x)$ at D.

Draw DE parallel to the ordinate axis to cut the abscissa at E.

It is then clear that $OE=x_n$.

The determination of S_n is shown in Fig. 4; here $OA = x_{n-1}$, AB is parallel to the ordinate axis and intersects $g(x)$ at B, BB′ is parallel to the abscissa and

$$OD = 2\sum_{m=1}^{l'} g(x_{2m-1})\triangle t - K$$

where $l' = \frac{1}{2}(n-1)$ when n is odd and $\frac{1}{2}n-1$ when n is even.

DE makes an angle β (=arc tan $\triangle t$) with the ordinate axis and cuts BB′ at E. EN also makes the angle β with the ordinate axis, to intersect the abscissa at N. EM is then drawn parallel to the ordinate and intersects the abscissa at M. Then $S_n(t)$ equals OM when n is odd and equals ON when n is even.

The paper continued by pointing out that both constructional and analytical errors were present. The former increases with $\triangle t$ and could be mitigated only by careful large-scale draughting. The latter arose from eqns. (3) and (4). The analytic error between the actual solution of eqn. (2) and its graphical solution is of the order of $\triangle t$.

DISCUSSION

MR. E. C. CHERRY (Imperial College of Science) said a linear system was something which did not occur in nature, yet they spent most of their lives

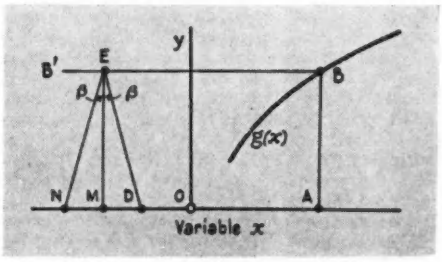


Fig. 3. Construction of eqn. (5)

in linear systems and their electrical upbringing was based upon them. That unnatural state of affairs was forced by the difficulties of analysis. There was a great resurgence of interest in modern times in non-linear fields, particularly in electrical engineering and aero-dynamics. Nevertheless, there was a lack of application to routine analysis of physical problems and a lack of practical computational methods. Miss Hsia's paper was a distinct contribution to this field.

Graphical methods were quite satisfactory provided you knew the degree of error you were making in the practical analysis, and that was dealt with in the paper.

Prof. A. TUSTIN (University of Birmingham) said the paper was none the less valuable because it was limited to second order systems. Although examples showed linearity in one variable only, the method lent itself to two non-linearities and covered a wide range of possibilities in simple systems. He had thought it might be possible to extend the scope to higher order systems, but so far had not been able to see how it could be done.

The fact that actual systems were more complicated, Professor Tustin said, did not detract enormously from the value of the method because the solutions could be obtained in a non-dimensional form which made them applicable in the second order systems to any problem.

MR. A. C. SIM (S. T. & C.), dealing with Miss Hsia's paper, declared that the paper started, in the first sentence, with a mathematical misstatement, and quoted a definition of the degree of equation. He was sorry that the author had not quoted supporting evidence, but he disagreed with Professor Tustin who had said that the method could not be extended. In fact, there were well-known methods of reducing higher order equations into simultaneous sets of lower order equations. Mr. Sim did not agree with the necessity for two restrictions in the paper. One was that the interval for $\triangle t$ should be the same at every step; in fact, there were advantages in allowing it to vary as the process continued. The second was in figure 3, the scale of x being equal to the scale of y this was not necessary.

MR. A. J. WAKEFIELD, dealing with Miss Hsia's paper, said in a number of practical applications, of which the neon tube and the van der Pol oscillator were examples, they were interested in the periodic solutions of the differential equations, which correspond to the behaviour of the system after operating for several cycles. In solving such an equation numerically with an arbitrary boundary condition it might be necessary to make the range of integration quite a number of cycles. He

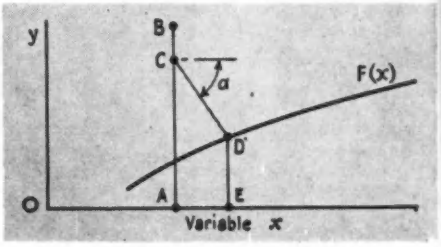


Fig. 4. Construction of Sn(t)

gave an example in the van der Pol case and said McLachlan gave such an approximate solution to the van der Pol problem in "Ordinary Non-Linear Differential Equations."

MR. J. HARMER said the great advantage of using a graphical method for performing a step by step calculation was that you could visualise the process of solving the equation and visualise the error involved at each step.

Professor Say replied to the discussion.

overseas news

Acquisition ?

The Fremantle Municipal and Electric Tramways Board has offered to sell its electricity supply undertaking and tramways and bus services to the Western Australia Government. It is known that the State Electricity Commission has been anxious to acquire the Fremantle undertaking for some time. But the commission has not been able compulsorily to acquire the undertaking as it has done others because there is a special Act of Parliament covering the supply of electricity to Fremantle which does not expire until 1967. Meanwhile, Fremantle has received a bulk supply at 0·85d. a unit from the commission, although it has been costing considerably more to generate. In the Legislative Assembly recently the Minister for Electricity, Mr. Brand, said that the agreement was costing the Government a loss of £90,000, which would probably increase to £150,000 in 1956 and £250,000 by 1961.

Railway Economics

If it were a matter of ruthless, cold-blooded economics, it would pay every railroad in Australia to run each steam locomotive into the sea, the Commonwealth Railways Commissioner, Mr. Hannaberry stated recently, when giving evidence before the North-South Rail Commission, sitting in Adelaide. He considered Diesel-electric locomotives provided the most economical railway operation. The commission is investigating alternative routes for the section of the proposed standardised North-South rail line between Stirling North and Brachina.

Self-Help Scheme

Already over a thousand people have responded to the new self-help finance scheme for rural electrification announced by the State Electricity Commission of Victoria to which we referred on November 1. Within three weeks the Commission had received offers promising £66,000 towards the cost of distribution extensions. The extensions are now being considered. It is stated that two large industrial consumers had also offered to meet the full capital cost of extension to their plant—£13,600. Industrial consumers have to pay the full cost, because of the high capital investment involved.

Manitoba's Need

If Manitoba is to have enough power to meet its requirements between now and 1962, it will be necessary to spend about $25 million annually on hydro-electric developments, probably for the next ten years, was the estimate given by Mr. D. M. Stephens, chairman of the Provincial Hydro-Electric Board recently. Emphasising the need to face reality, he recalled that some weeks ago the Board had recommended to the Winnipeg City Council the implementation of Plan "C" of the Hogg report. But the council's reaction was still awaited.

Seaway Bills

Two Bills, which bring nearer realisation of the St. Lawrence seaway and power project, were given a third reading in the Canadian Parliament last Thursday. One Bill authorises the setting up of a St. Lawrence seaway authority to construct and maintain a deep waterway between Montreal and Lake Erie; the other ratifies the recent agreement between the Federal and Ontario Governments on hydro-electric power development in the International Rapids section. As we have already reported, there is a condition attached to the 2,200,000 h.p. project—there must be a power agreement with the New York State authority, but this is clearly expected in Toronto.

Canadian Production Mystery

Are Canadian electrical manufacturers booming or are they in a bad way? Here are two views: At Winnipeg recently, Mr. P. Murphy, vice-president and managing director of the Northern Electric Co., said that Canadian output of electrical apparatus was expected to exceed $600 million this year—$20 million more than in 1950. But in Ottawa on the same day, Mr. D. N. Simpson, manager of the Canadian Electrical Manufacturers Association, told the Special Parliamentary Committee on Retail Price Fixing, that the Canadian electrical manufacturing industry had hit a slump and "was on the way to being liquidated." For this he blamed, principally, the higher Government excise and sales taxes. He explained that the Government had planned to place a defence production load of not more than 20% on the industry. But at present this burden was only about 3 or 4%.

Change of Supply ?

Citizens of Prince Rupert were asked to give their views at the civic elections this month, on the question of whether electricity for the island should continue to be taken from the Northern British Columbia Power Co., or if supply should be changed to the British Columbia Power Commission. The power company admit that the demand is now taxing its hydro-electric resources and recourse has been made to Diesel generators. A new hydro-project should be started immediately to be finished within five years, but the company does not propose to go ahead with the plans until the question of the franchise, which expires in two years, is settled.

Luxembourg H.E. Project

A new company, the Société Electrique de L'Our, has been constituted in Luxembourg to carry out a hydro-electric project in the Our valley. Initial work will include the construction of a dam 65 metres high, retaining between 100 and 125 million cubic metres of water. The capital of the new company has been provisionally fixed at 15 million Luxembourg francs, but may be raised to 3,000 million or 4,000 million within a year, the Luxembourg State being the principal shareholder. Other participants include the Ste Ofinco of Geneva, the S.A. Entreprises Compenon Bernard of Paris, the Cie. Grand Ducale d'Electricité and the International Bank at Luxembourg. The Board of Directors of the company has authorised the Rheinisch Westfaelische Electrizitaetswerke to draw up final plans for the dam, the pumping station at Wahlhausen and the power station (including the turbines) which is to be built at Stolzemburg-Vianden. Work on the main project is expected to begin within a year and will take six or seven years to complete while total costs are estimated at between 3,000 and 4,000 million Luxembourg francs.

Mica Price Control?

A suggestion for the fixation of minimum prices of mica, to help safeguard the interests of the Indian mica industry, was discussed at the ninth meeting of the Mica Advisory Committee at Jaipur, earlier this month. The suggestion was made by the industry itself, apparently, in view of the reported considerable drop in prices in America. The Committee also discussed measures for control of prices.

"Co-op" Station

A co-operative hydro-electric power station, the first venture of its kind in the State, was officially inaugurated at Bandipore, 35 miles from Srinagar, a few days ago. The generating plant has an initial output of 35 kW.

Import Relaxation

The New Zealand Board of Trade has now approved of consideration being given to applications for import licences for certain goods which have no allocation under the 1952 Import Licensing Schedule, but only where it is established that the goods are of a kind not made in New Zealand. The items listed include electric cooking and heating appliances (excluding cookers), batteries and cells, insulators and storage batteries. Other items changed from "D" to "C" in the Schedule, for which applications for licences are considered individually, include 2, 3 and 4-core covered flexible wire, mill exhaust fans of 5 in. dia and over, loudspeakers less than 3 in. dia or not less than 12 in. dia, and loudspeakers specially suited for outdoor use.

Appliance Approval?

Although supporting the efforts being made to set up an approval board for electrical appliances that it is proposed to market, and for the sale of all electrical equipment to be placed under stricter supervision, Mr. G. H. Battersby, acting engineer-manager of the Christchurch (N.Z.) Municipal Electricity Dept., feels that there is much unnecessary talk about the alleged shoddy equipment being sold in New Zealand. He considers a good deal of the equipment is only dangerous when it is abused. Dealing specifically with appliances sold minus plug tops, he quoted an instance of a man who went to the department's showroom, complaining bitterly that a heater, which he had fitted with a two-pin plug top himself, blew the fuse whenever it was turned on, said Mr. Battersby. It was found that he had connected the two main wires to their proper pins, but had been at a loss to know what to do with the third. He had overcome his difficulty by dividing the wire strands of the earth core into two parts, and connecting one part to each of the two main pin terminals!

The Tariff Problem

Area Boards facing criticisms of their new standard domestic tariffs may take heart from recent remarks of Mr. J. M. Bishop, manager of the South Canterbury Electric Power Board (N.Z.). In his survey of the Board's domestic tariff, he emphasises that if the unlit room or closed verandah are abandoned as rooms (at a service charge of £1 each) the revenue lost can only be made good by an increase in charges in some other part of the tariff. It was the considered opinion of authorities that to ensure the fullest use being made of electricity, the price of the final marginal units must be such that the consumer is willing to use another unit of electricity rather than use gas, coal or oil, and to that end the low rate units should not exceed ¾d p.u., and where possible not exceed ½d p.u. He recommended the Board to reduce the general purpose low-rate units (now at 1d) to ¾d p.u., and to include all domestic supplies in the one meter, including water heating. The idea of charging £1 per room per annum was to ensure that each householder should contribute his share of the total capital charges of about £30,000. Thus the service charge for a small house would be less than for a large one. "Under these circumstances surely the Board should not concern itself as to whether one or more of the rooms is lit or unlit," he added.

Power Discussions

Following earlier representations, closer liaison has been arranged between power supply authorities and the Minister and officers of the State Hydro-Electric Department. A special committee of the Supply Authorities' Association has been set up at the invitation of the Minister in charge of the department, Mr. Goosman, to discuss power problems with himself and his officers from time to time. The idea is to allow a freer exchange of views in round-table discussions than has been the practice so far. Reporting this, Mr. C. J. Lovegrove, president of the Association, and chairman of the Auckland Electric Power Board, described the proposal as a most progressive step.

PERSONALITIES

IN THE INDUSTRY

We understand that **The Hon. J. R. Rea,** M.A., Barrister-at-Law, and comp. I.E.E., has left his position as secretary of The British Electrical and Allied Manufacturers Association, which he has occupied since 1938. This follows a trying period of anxiety regarding personal affairs. His present address is 2 Lyndhurst Road, Hampstead, London N.W.3. Educated at Westminster School, Grenoble University, and Christ's College, Cambridge, he was called to the Bar by the Middle Temple in 1925, and practised as a barrister until 1934, when he was appointed senior legal assistant in the Treasury Solicitor's Office. He joined the BEAMA in 1936 as legal assistant to the late C. A. Weekes, whom he succeeded in 1938 on the latter's retirement. In May of the same year he was appointed secretary of the Association.

Hon. J. R. Rea

Three new appointments in the electrical engineering new works and development organisation, at Headquarters in London, are announced by the Railway Executive, British Railways. **Mr. W. J. Webb,** B.Sc.(Eng.), A.M.I.E.E., at present senior technical assistant (power supply), London Bridge, is to be assistant for substations; **Dr. H. I. Andrews,** M.Sc., M.I.Mech.E., A.M.I.E.E., now senior assistant (engineering) at the Derby Research Department, is to be general assistant; and thirdly, **Mr. E. Claxton,** B.Sc.(Eng.), Assoc. M.Inst.C.E., A.I.Mech.E., A.M.I.E.E., at present assistant electrification engineer, electrical engineering new works and development section, King's Cross, is to be electrification engineer. Mr. Webb started with the Southern Railway in the department of the electrical engineer for new works, and in 1930 was placed in charge of the drawing office. He assisted the electrical engineer with the formulation of reports and estimates for all electrification schemes. In 1947 he became assistant for power supply (new works) in the chief electrical engineer's dept., and in 1950 senior technical assistant in the Electric Traction Section of the Mechanical and Electrical Engineer's department, Southern Region. Mr. Andrews gained early traction experience with the English Electric Co., and in 1934 he joined the Engineering Section of the L.M.S. where he developed a number of specialities. His major work has been the study of loco performance for which he developed the mobile testing plant. Mr. Claxton was earlier this year in charge of co-ordination of electrical work for the Manchester-Sheffield electrification, and since August has been assistant electrification engineer (L.M. and S. Sections). From 1931 to 1937 he was engaged on construction of the national grid in Scotland, and other works for electricity undertakings in Scotland and Northern Ireland, prior to joining the L.N.E.R., with which he was associated in the design and production of electric locos and multiple unit stock for the Manchester-Sheffield electrification.

His friends will join in offering congratulations to **Mr. C. W. Marshall,** B.Sc.(Eng.), M.I.E.E., the British Electricity Authority's deputy chief engineer (research), on the distinction of Honorary Membership which has recently been conferred upon him by the Societe Francaise des Electriciens, the French equivalent of the Institution of Electrical Engineers. Mr. Marshall was formally invested with his new honour at a meeting of the Society in the Salle des Conferences in Paris on December 1 by M. Laborde, the president, who paid tribute to his valuable work.

Now in this country is **Mr. L. E. Tarr,** A.I.Mech.E., Assoc.I.E.E., assistant general manager of the Trinidad and Tobago Electricity Commission, who, prior to going to the West Indies in 1948, had served for some time with the Contracts Department of the Metropolitan-Vickers Electrical Co., Ltd., and with the Calcutta Electric Supply Corporation, Ltd. Although really on leave, Mr. Tarr has been mostly concerned here with the Commission's business, we understand. He returns to Trinidad again in the S.S. *Golfito* from Southampton on January 10.

I.T.D., Ltd., the selling organisation for "Stacatrucs," "Aerolift" Fork Trucks, and "Electricar" works trucks, announce that **Mr. R. T. Hartmann,** M.A., is no longer connected with the company. **Mr. A. C. Cooper,** who has until now been U.K. Division manager, will be acting sales manager of the company in charge of both home and overseas business.

Mr. H. C. Day, M.Inst.C.E., M.I.E.E., district commercial officer at Bury, to the North Western Electricity Board, retired a few days ago. Prior to vesting day, Mr. Day had been borough electrical engineer and manager of the Heywood Corporation undertaking for 26 years; for he joined that department in 1922 when the corporation operated a tramway system, of which he was also manager.

To mark his retirement after 30 years' service as a turbine driver at Derby power station, East Midlands Division of B.E.A., **Mr. L. R. Cape** was recently presented with a cheque from his colleagues, by Mr. H. Topley, A.M.I.E.E., the station superintendent.

Three scientists have been promoted to the rank of Chief Scientific Officer in the Royal Naval Scientific Service. They are: **Mr. J. Anderson,** C.B.E., M.I.E.E., Chief Scientist at the Admiralty Signal and Radar Establishment, Haslemere, Surrey; **Colonel A. V. Kerrison,** Director of Aeronautical and Engineering Research at the Admiralty, and **Dr. E. C. S. Megaw,** M.B.E., D.S.C., B.SC., M.I.E.E., Director of Physical Research at the Admiralty. Mr. Anderson gained post-graduate training with the B.T.-H. Co. prior to joining the Admiralty Experimental Station at Parkeston Quay, Harwich, in 1918. He was concerned in the very early stages of work on Asdic equipment, and has been associated with the subsequent development. Dr. Megaw, a specialist in the subject of valve oscillators at high frequencies, helped to develop many wartime devices which made radio equipment more efficient.

Mr. A. G. Jones, section engineer at Towyn (Merioneth) for the Merseyside and North Wales Electricity Board, has been promoted to first assistant distribution engineer for the Board's Aberystwyth district. Before vesting day, he was engineer-manager of the Towyn, Aberdovey and District Electricity Co. Ltd.

Sir Edward Wilshaw, governor and managing director of Cables and Wireless (Holding) Ltd., and this year's Diamond Jubilee President of the Chartered Institute of Secretaries, last Friday received the honorary degree of Doctor of Laws at Birmingham University.

Formerly deputy station superintendent at Bow generating station, London Division, of the B.E.A., **Mr. H. Kehoe,** A.M.I.E.E., has now taken up duties as station superintendent at Lincoln (East Midlands Division). Before leaving Bow recently, he was presented with a travelling bag by his colleagues.

In our note last week, the name of Mr. J. H. Robertson, of Albion Electric Stores, should have read **J. H. Rogerson.**

OBITUARY

The death occurred recently of **Mr. W. A. Scott,** aged 63, who, before his retirement five years ago was superintending engineer at North Tees power station. He began his career with the former Tynemouth Corporation electricity undertaking.

American Mine Electrification

COAL mine electrification is discussed at some length in the newly issued Anglo-American Productivity team report on Coal. It is stated that in the United States the all-electric mine is the commonplace, and the great majority of the companies concerned buy their power from the public utility companies. Installed capacity consumption and cost of electrical energy per ton of coal mined is below British levels because of the different natural conditions. The national average for consumption was 9 units/ton in 1949. Increased electrification is expected over the next ten years. Power factor of demand is kept up to 0·9 and better, and load factors between 50 and 55% are achieved.

Incoming supplies are usually transformed to 4·4 or 2·3 kV for distribution, or to 230 V where a.c. machinery is in use. In substations the absence of circuit-breakers is stated as being "noticeable"; often fuses only are provided for fault protection at the load end of the surface transformer feeders.

Lower Standards

Standards and practice in distribution and utilisation below ground are below British levels. Distribution from the mine substation is usually by d.c. systems, of which bare overhead trolley wires nearly always form part. Frequently, distribution for both transport and face equipment is entirely through the trolley wires. To overcome voltage regulation problems as the mine extends, bore holes are put down from the surface, and cables led through them. The relative shallowness of the workings makes this procedure comparatively easy and inexpensive.

Conversion from a.c. to d.c. was originally carried out by m.g. sets or rotary converters, but mercury arc rectifiers or more recently ignitrons are accepted modern practice. Most state laws prohibit voltages higher than 300 and this makes more difficult the voltage regulation problem.

Equipment

American accent on simplicity has led in some ways to the adoption of unsatisfactory arrangements for underground installations, such as fuse protection only, and reliance on knife switches for circuit isolation. Work on intrinsically safe circuits is following the same lines as in Britain, but the same standards have not yet been adopted.

Starting and controlling equipment for underground machinery is very often incorporated in the appliance itself. Trailing cables are usually made up in flat form, with two power cores and an uninsulated earth conductor between them, and a neoprene sheath. Flame resistance tests are less onerous than in the most recent British Standard.

The report rejects the common idea that the Americans "scrap and replace" their equipment. Much attention is given to maintenance and repair, and those in charge of this type of work enjoy a high status in their companies. Tradesmen for such work do not go through any form of craft apprenticeship; they become electricians' or mechanics' helpers and, if skilful enough, are informally upgraded to craftsmen. No one was met who was dissatisfied with the results of this system, but the team sees some long term disadvantages in it.

Published by the Anglo-American Council on Productivity, the report is available from 21 Tothill Street, London S.W.1, price 3s. 6d.

NEW LITERATURE

The Electric Current

by P. Dunsheath, C.B.E., M.A., D.SC., F.Inst.P., D.Eng.

THE remarkable success of the Christmas lectures at the Royal Institution each year is undisputed and there is no reason to suppose that the above-named book which recaptures the atmosphere of those talks so perfectly, will prove any the less attractive. It is based on the course of six lectures delivered during the Christmas holidays of 1949-50. In like comparison, just as the lectures are intended for youth and usually attended by more than a sprinkling of parents and older persons, so also "The Electric Current" is bound to find its way to the hands of fathers, uncles and teachers.

With so wide a subject as electricity, the initial problem of the young aspirant to electrical education may well be where to start in his quest for knowledge. Should this be the case there can be few better recommendations than this volume as a springboard. The author covers a lot of ground in the electrical field and by the time the last page has been reached the reader has been taken methodically, succinctly but thoroughly from Galvani's twitching frogs' legs to the most modern equipment. Published by Bell and Sons, Ltd., 211 pages, 8½ in. by 5½ in. Price 18s. 6d.

Electric Lifts

by R. S. Phillips, M.I.E.E.

NOW appearing in its third edition, this well-known textbook on lifts has been extended, brought up to date in many details which will make it even more valuable to its users. In particular, there is a detailed analysis of lift traffic data, necessary in designing lifts for large buildings. General form of the work, remains as before. After a review of lift design, accommodation, types of drive and roping systems are described, and then the various items of car equipment and driving motors are dealt with. Other chapters cover safety features, maintenance and testing, and lift accidents. A series of six appendices covers various practical details and adds considerably to the value of this volume as a reference work. Published by Pitman, 377 pages, 8½ in. by 5½ in. Third edition, price 50s.

Fractional Horse Power Motors

by S. F. Philpotts, M.I.E.E., F.B.H.I.

FRACTIONAL horse power motors have so widespread an application nowadays, that questions on their operation and adjustment frequently arise. In the volume under review, the author has attempted a general survey of the commoner types of machine for those who have to apply such machines, as distinct from designing them. The greater part of the book is devoted to a description of the characteristics and construction of f.h.p. motors, considered in their principal groups. In every case there is consideration of such matters as speed control, reversing procedure, and of common faults

Subsequent chapters deal with general considerations of motor construction with special attention to bearings, to the choice of motors for given purposes, typical existing applications, and to the testing of f.h.p. motors. A final section on radio interference suppression will be found helpful in dealing with many problems in that field. Published by Chapman and Hall, 367 pages, 8½ in. by 5½ in. Price 30s.

Electroplating

by S. Field, A.R.C.Sc., and A. D. Weill

REACHING its sixth edition in its coming-of-age year, this well-known textbook has been thoroughly revised to take account of war-time developments which have now become established techniques. The well recognised features of the book are retained, and in particular its admirable treatment of the chemical and electrical theory on which electroplating practice is based. This section is followed by more specifically practical information on such matters as solution properties, plant details, cleaning and polishing. Then come the eminently useful series of chapters on the deposition of specific metals and alloys. In these, all aspects of working with the individual materials are discussed, with hard quantitative details that are most valuable as reference material to the practicising electroplater. In the present volume this work is rounded off with some notes on the testing of electro deposits and on metal colouring. Published by Pitman, 546 pages, 7¼ in. by 4¾ in. Sixth edition, price 20s.

BOOKS RECEIVED

Ordnungsprobleme der Energiewirtschaft: Zeit- und Betriebsvergleich in der Energiewirtschaft, Part 4 of series "Tagungsberichte des Energiewirtschaftlichen Instituts". Published by Energiewirtschaftliches Institut of Cologne University. Price DM15.

Photoelectric Tubes, by A. Sommer. Monograph on electronic tubes based on photoelectric emission. Published by Methuen and Co., 118 pages, 6½ in. x 4 in. Second edition, 8s. 6d.

Conduction of Electricity Through Gases, by K. G. Emeleus. Monograph on general phenomena. Published by Methuen and Co., 99 pages, 6½ in. x 4 in. Third edition, price 5s. 6d.

Electrical Phenomena at Interfaces, edited by J. A. V. Butler. Collection of articles by specialists covering most of basic researches on the subject. Published by Methuen and Co., 309 pages, 8½ in. x 5½ in. Price 32s. 6d.

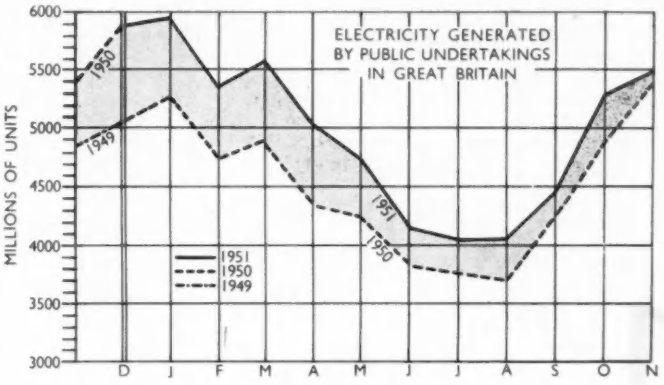
The Futures Markets, by J. F. Blitz, M.A., B.SC. Elementary introduction to subject. Published by the Purchasing Officers' Association, 146a Queen Victoria Street, London W.1, 14 pages, 8½ in. x 5½ in. Price 2s. 6d.

UNITS GENERATED

5,488 million units was the total generated during November in stations under the control of the B.E.A., the North of Scotland H.E. Board and the Lochaber Power Co. The corresponding figure last year was 5,365 million, so there has been an increase of 2·3%.

Of the total, 5,309 million units was generated in steam stations and 165 million in hydro-electric.

Energy sent out during the month was 5,181 million units, 94·4% of that generated. This gives the total for the year up to November 30th as 51,092 million units, showing an increase of 10·3% on the same period in 1950.



POWER SUPPLY IN NOVEMBER

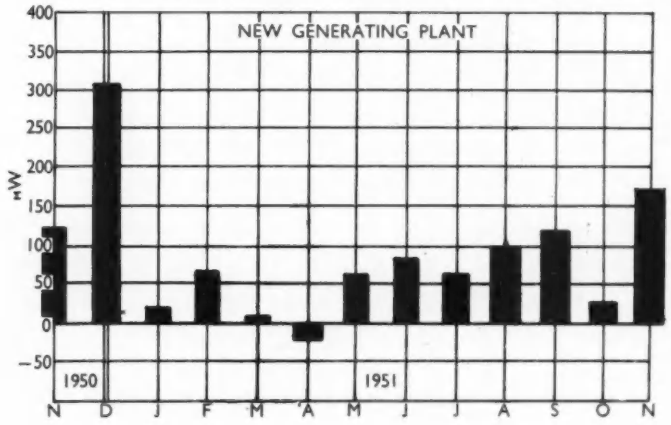
STARTING in the south of the country, Poole power station (Southern Division) heads the list of generating plant newly installed in November. The unit concerned is a 300 klb/hr International Combustion Co. design, and is the fourth of eight planned for the station. Rye House, near Hertford, in the Eastern Division, figures in the list for the first time, with a 350 klb/hr Babcock and Wilcox boiler. Present plans for this 600/850 station provide for four such boilers and for four 32 MW sets.

At Llynfi, in the South Wales Division, the installation of a 30 MW English Electric turbo-alternator brings the capacity of the station up to 120 MW, and completes current extension plans. Farther north at Birkenhead, the Bromborough station registers its first set, a 50 MW English Electric hydrogen-cooled machine. Steam conditions are 900 lb/sq in. 900° F, and plans up to 1956 provide for four such sets and eight 300 klb/hr boilers.

In Yorkshire the Leeds Skelton Grange plant has been extended by the installation of a second 60 MW set of C. A. Parsons design, the station capacity coming up to 120 MW out of its present planned total of 360 MW. Finally in the list is the South West Scotland Division, represented by the Clydes Mill station at Glasgow. A second 30 MW English Electric set has been installed here, making the overall capacity 218 MW.

Coal Saving

It is notable that almost the same amount of coal was used in power stations in November, 1951, as in the same month of 1950, and some 23% less oil was burnt. Yet the units generated by steam power were, at 5,309 m. units, some 2% up on the previous November total.



GENERATING PLANT

At the end of November, 1951, the installed capacity of the B.E.A. was 15,161 MW, showing an increase of 169 MW during the month. During the same period the North of Scotland total went up by 1 MW to 616 MW. The month's commissionings bring the overall increase during the past twelve months to 1,012 MW, or 6·9% of the November, 1950, total.

The total installed capacity used for the purpose of this graph should be distinguished from the output capacity. The installed capacity is the total m.c.r. of all the generating sets which are connected on both steam (if appropriate) and electric sides, and are suitable for service.

CODES OF PRACTICE

Domestic Electric Water-Heating Installations.—*C.P.324.202. Price 3s.* Now appearing in its final form, this Code of Practice is essentially a document of practical advice on its subject. After the usual early sections of definitions and recommendations, the code passes to design considerations, and includes some useful notes on storage temperatures and on the use of various metals and finishes as affected by hardness of water supply and by its acidity. Turning to installation matters, the code discusses at some length the location of storage vessels, and the details of immersion heater installations. Special attention is paid to thermal installation of tanks, and some striking heat loss figures are quoted to support the arguments put forward. Plumbing is, of course, covered in some detail.

A series of appendices dealing with heat loss and drop in head with given water flows add to the value of the code.

Staff Location Systems.—*C.P.327.402. Price 3s.* —This code has been drawn up by a Committee convened by the Institution of Electrical Engineers on behalf of the Council, and is a revision, following comments received, of the draft code previously issued. It forms part of the series concerning telecommunication services in and about buildings, and deals with the installation of systems which provide audible or visual signals for attracting the attention of an individual who may be anywhere in a building or on a site.

Advice is given on the necessary consultation at the planning stage and on the choice of materials, appliances and components. Recommendations are given on the design of various types of system, on methods of wiring, and on power supply. Provision of the necessary structural accommodation for the equipment and wiring is also dealt with. Sections on inspection and testing and on maintenance are included. Appendices deal with the segregation of services and with certain special types of cables.

Codes of Practice noted above are prepared by the Council for Codes of Practice for Buildings, and are issued on behalf of the Council by the British Standards Institution, 24, Victoria Street, London, S.W.1, from whom they are obtainable at the prices stated.

Lighting Criticised by Research Station

ISSUED last week by H.M. Stationery Office, the report of the Building Research Board and of the Director of Building Research for 1950 has scattered through its 68 pages several items of interest to the electrical contractor, installations engineer, and manufacturer. In the covering Board report, the Chairman, Mr. W. K. Wallace, C.B.E., M.I.C.E. notes that studies on factory design proceeded steadily during 1950, and that earlier this year the stage was being reached where separate investigations on lighting, heating and ventilating, noise, and the use of colour could be integrated into recommendations for the use of designers.

In the Director's report there is mention of the completion of work on electro-osmosis as a means of drying out clay. This has been reviewed earlier in the ELECTRICAL TIMES, and the report here repeats the finding that while large scale drying out was possible, the effect was confined largely to the soil within two or three feet of the electrodes.

Lighting

General research on the efficiency of buildings included the initiation of an investigation jointly with the Medical Research Council on some of the effects of fluorescent lighting, the initial study being of the effect of flicker. Apparatus was constructed which enabled both the frequency and wave form of an alternating light source to be changed, and the effect on visual comfort to be appraised.

Work on heating and ventilation continued on domestic buildings at Abbots Langley and at Garston, and studies on these matters and on lighting have also been made on various special types of building. In schools and colleges, for instance, it was found that there was general dissatisfaction with the artificial lighting units being supplied for use in classrooms. Criticisms were made of technical design, appearance, and often cost. To meet this problem, certain development and design work was started, the basis being maximum brightness at within an angle at the eye of 140° from floor perpendicular, 2·5 c/sq in.; brightness of unit to grade off towards the edge; half the light to go to the working plane and the remainder to be distributed more or less evenly between walls and ceiling.

For industrial buildings some points about artificial lighting were noted for study. In general, lighting for productive work was worse than for clerical and ancillary work, and for dirty work it was worse than for clean. This, comments the report, seems the wrong way round. Glare was widespread, and there was failure to appreciate the importance of lighting the work preferentially. The trouble, as with schools, seemed to be the lack of really suitable lighting units.

In regard to hospitals, a new artificial lighting unit was developed for general use in wards, and bed lighting was studied, preliminary results making counter-poised units appear very promising.

The report, which reviews all aspects of the Building Research Station's activities, is published by H.M. Stationery Office, price 4s.

The BUYER'S *Column*

G.A.C./Clix Sales Arrangements

SUBSEQUENT to the acquisition by EDISON SWAN ELECTRIC CO., LTD., 155 Charing Cross Road, London W.C.2, of the share capital of the GENERAL ACCESSORIES CO. and BRITISH MECHANICAL PRODUCTIONS, LTD., the following modifications to the existing commercial arrangements will come into force.

From January 1, 1952, all G.A.C./Clix products, together with new products as they become available, will be sold through the distribution channels of The Edison Swan Electric Company, Ltd., namely, through their 26 district offices and substores.

Queries concerning outstanding orders which remain on the General Accessories Co. on December 31, 1951, should be addressed to the General Accessories Co., Barton Hill Works, Bristol 5. All new orders or inquiries subsequent to that date should be passed through Ediswan district offices.

In connection with these new lines The Edison Swan Electric Co., Ltd. will pursue its normal methods of trading with due reference to the appropriate association arrangements.

A Battery Driven Display Turntable

POWERED by a 4·5 V dry battery, a small precision display turntable has now been marketed by W. J. SAVILLE & CO. LTD., Savko House, Eagle Wharf Rd., N.1.

Made from black Bakelite with tray diameter 5½ in. at £6 10s. or white Bakelite tray diameter 8¾ in. at £7. The turntable is capable of taking weights up to 10 lb. with ease at a speed of three complete revolutions per minute.

Overall height of the turntable is 3½ in. With normal load the table will operate for fourteen days before the battery is exhausted. Smooth movement is ensured by the incorporation of four jewels and five ball-bearings in the mechanism.

Price Changes

AS from December 1, 1951, H. FISHER (OLDHAM), LTD., Glodwick Road, Oldham have reduced some of their list prices for washing machines. The new prices for the Standard type washers are as follows: Standard washer without pump for a.c. supply £50, plus £26 p.t. Standard washer with pump £55, plus £28 12s. p.t. D.C. models are reduced in proportion.

The company has also announced a special retrospective refund scheme for machines held by stockists and bought between May 1 and November 30, 1951. Full details are available direct from H. Fisher (Oldham), Ltd. It is understood that the price reduction will only refer to their Standard type model, and not to the other models of their range.

It is announced by EASIPOWER LTD., 213, Gloucester Road, London N.W.1 that on and after January 1, 1952, the "Easipower" Heat Test Meter will cost £6.

"Pilot" Cable Drum Trailer

RECEIPT of an illustrated folder from RICHARD C. GIBBINS & CO., LTD., 43 Berkeley St., Birmingham 1, brings into prominence details of the "Pilot" cable drum trailer which is the latest equipment to be introduced by the firm.

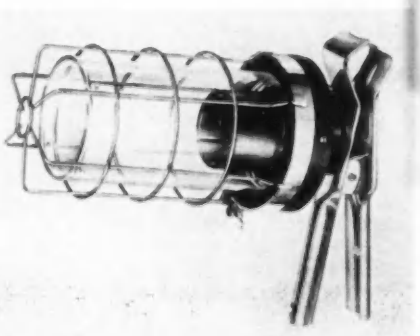
Always the large cable drum has presented a tough handling problem. The drums are heavy and the job of transporting them, manoeuvring them into position and paying out the cable has always called for a degree of manual effort which was most unsatisfactory, so the company devised a trailer chassis which makes handling of the drum and the cable an easy matter.

This trailer will accommodate cable drums of 3 ft to 7 ft 6 in. diameter and up to 3 ft 8 in. width. Its unladen weight is 19½ cwt, but it can handle drums weighing up to 4 tons. Two ratchet-operated jacks are incorporated in the chassis design obviating the use of external lifting gear, by means of these a drum is quickly and easily raised off the ground to a position in which the trailer can be moved away and the cable paid out.

A New "Gripper" Lamp

LATEST addition to the Gripper Handlamp family, which has been reared by BRITISH CENTRAL ELECTRICAL CO., LTD., 6 and 8 Rosebery Avenue, E.C.1, is the "Perspex" well-type handlamp.

This new member of the family has been especially designed in order to satisfy certain requirements in the industries mainly concerned with the preparation of food. It obviates the use of glass, therefore ensuring that broken glass fragments cannot become one of the ingredients of the preparation. List price is £3 5s.



The new "Perspex Well" Gripper Lamp is ideal for local lighting in the food industries

The Multitone Compactor uses the smallest batteries available

Multitone's Compactors help the Deaf

ONE of the latest introductions in the range of hearing aids marketed by MULTITONE ELECTRIC CO., LTD., 223/227 St. John St., Clerkenwell, E.C.1, is the "Compactor."

It has been designed to give high performance and reliability from an aid of the smallest possible dimension. To achieve this end the unit embodies an unusual construction.

It is an elegant, extremely light and small unit and is filled with noise moderator equipment to prevent an excessive volume of sound reaching the ear.

Only one control, a combined switch and volume control, is employed ensuring extreme simplicity of operation. Batteries used are the smallest 15 V layer types available; these give 150 hours' use, the l.t. battery giving about 35/50 hours. Weighing less than 4½ oz complete with batteries, the "Compactor" measures 2·6 in. x 2 in. x 0·72 in.

In addition to the "Compactor" illustrated, the company has just introduced the "Compactor P" which, 1½ in. longer, uses the Ever Ready D.14 low tension battery instead of a Mallory cell.

TRADE PUBLICATIONS

MERCURY ARC INVERTORS.—An article from the ELECTRICAL TIMES entitled "Invertors for Industry" has been reprinted by the Nevelin Electric Co. Ltd., Purley Way, Croydon, Surrey, in the form of a booklet.

CIRCUIT BREAKERS.—"S.S." circuit breakers are featured in a new publication by English Electric Co. Ltd., Queen's House, Kingsway W.C.2.

VISUAL AID EQUIPMENT.—The range of visual aid equipment supplied by Newton and Co. Ltd., 72 Wigmore St., London W.1, is illustrated in a leaflet published by the company.

PUBLIC ADDRESS EQUIPMENT.—In an illustrated folder just issued by Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2, there is a detailed description of the A035A microphone, made by the company

ALUMINIUM ALLOY FORGINGS.—High Duty Alloys Ltd., Slough, Bucks, have issued in brochure form a reprint from *Light Metals* of the article, "Aluminium Alloy forgings—a note on progress," by C. Wilson, PH.D., A.R.S.M.

CABLES AND EQUIPMENT.—New catalogues "C" and "J," issued by W. T. Henley's Telegraph Works Company Ltd., 51-53 Hatton Garden, London, E.C.2, deal comprehensively with paper cables to B.S. 480/1945 and jointing materials (tapes and compounds).

PLUGS AND SOCKETS.—Marine watertight plugs and sockets in cast brass are set out in a list issued by Metway Electrical Industries Ltd., King St., Brighton 1.

INDUSTRIAL DRIVES.—Under the general heading "L.D.C. The Symbol of Power in Industry," Lancashire Dynamo and Crypto (Mfg.) Ltd., Trafford Park, Manchester 17, are producing a series of booklets illustrating the application of their products. The second issued shows how L.D.C. motors are widely used in industrial drives.

INDUCTION HEATING.—The first two brochures issued by Birlec Ltd., Tyburn Road, Erdington, Birmingham 24, of a series describing all types of Birlec induction heating equipment deal with surface hardening and localised heat treatment applications respectively.

CIRCUIT-BREAKERS.—Catalogue section S112, just issued by Cooke and Ferguson Ltd., Victoria Street, Manchester 11, deals with Type OD2 outdoor circuit-breakers.

GENERATORS.—New brochure B1720, entitled "Revolving Field Alternators," together with dimension leaflets A.C. 302, 3 and 4, has been issued by the Electric Construction Company Ltd., Wolverhampton.

FLEXIBLE CONDUIT.—From the Compoflex Co., Ltd., Morden Road, London S.W.19, we have received a copy of a brochure which provides technical information concerning the characteristics of Compoflex tubing and the various uses for which it has been successfully adapted.

FUSE AND SWITCHGEAR.—In an attractive folder/booklet Revo Electric Co., Ltd., Tipton, Staffs, have set out illustrations and details of the range of switch and fuse gear which they supply.

ELECTRICAL PLANT.—Four new publications recently issued by English Electric Co., Ltd., Queens House, Kingsway, W.C.2, are: "The Magnavolt Exciter, a Rotating Amplifier"; "The Magnavolt Exciter and Its Application"; "Air Compressor Equipments"; and "Stourport 'B' Generating Station."

TRINIDAD'S MAJOR DEVELOPMENT

Island-wide Electrification Scheme under Way

GREAT store is set in Trinidad on the inauguration of the island-wide electrification scheme, which was put forward by the Trinidad and Tobago Electricity Commission about three years ago. At that time the estimated cost was put at $6 millions, and in addition to a 66 kV transmission lines system and an extensive distribution network, the scheme provided for the erection of a new power station at Penal housing two 5,000 kW turbo-alternators. Progress made in this work is referred to in the 1950 Report of the Commission just to hand.

Site work for the new station was rather slow due to the failure of the dry season to materialise, the constant heavy rains causing much delay. But material for the boiler plant and turbines arrived during the year and some outbuildings were completed. It is hoped that the station will be brought into operation in the early part of 1953, but some sections of the new 66 kV and 33 kV line were put into commission last year together with 65 miles of other o.h. line.

The Commission's existing power plant consists of two steam generators, totalling 7,500 kW,

Penal station steelwork being erected

which were operated as base-load units, and three diesel sets of a total capacity of 6,200 kW. The latter, used only for peak load periods, were responsible for only 5·5 million units (11·80%) of the total of 47·1 million units generated. In addition some 723,500 units were taken from the Pointe-a-Pierre power station of Trinidad Leasehold, Ltd. From the total, the Commission supplied over 24 million units to the Port-of-Spain Electricity Board at an average price of 2·9 cents per unit.

In the West Indies, of course, there has been rapid electrification during the past decade, which is typified by the experience of the Commission, quoted in the report. This shows that the peak maximum demand on the system in 1950 (10,400 kW) was almost four times the maximum load in 1940. Compared with 1949, units sold by the Commission last year increased by 1,939,260, of which over 675,000 extra were taken on the domestic light and power tariff.

Industrial power accounted for just over 8 million of the total of 17·4 million units sold during the year. On the domestic light and power tariff there were 2,969 consumers—an increase of 253—whose average consumption for the year was 1,731 units. The largest number of consumers are on the general lighting rate, of course, and here there was an increase of 1,177 in the year, bringing the total on that tariff to 9,049, whose average consumption was only 184 units p.a.

In all, the Commission connected 1,505 new consumers during the year, but was not able to supply any large consumers owing to the continued shortage of generating plant. So, the sooner the Southern power scheme is completed the happier the calypso singers will be.

PLANNING LONDON

DETAILED information was released last week on a twenty-year plan for reorganising the administrative County of London, including the city. So far as industry is concerned, the plan provides that light industries shall be located in suitable sites in residential areas. Special industries, which are noxious because of unpleasant odours or poisonous fumes, will be specially zoned, though moving them is likely to be difficult. Involved in this matter of locating industry is the problem of travelling to work, which is stated to be an ever-growing problem. In all, the plan allocates about 4,012 acres for industry, against 4,111 acres existing. Of the existing total, 1,457 acres are in residential zones and need to be relocated.

With regard to railway expansion and electrification within the county, the plan merely notes the proposals of the Railway Working Party for tunnel routes of main line size, but does not integrate them in the plan because there has as yet been no Government announcement.

The need for electricity is noted as likely to increase, in spite of reductions in the population. It is expected that new power stations, additional to the 18 within the county, will be sited on the marshes of the Lower Thames. Within the county, the importance of watching amenity aspects is emphasised. It is noted that more than a million tons of ash from power stations has to be disposed of every year, most of this going for land reclamation. District heating as a means of reducing atmospheric polution and economising in fuel is noted as in need of being kept under review.

THE WEEK

COMMERCE *in news* COMMERCE

Plans to increase Dollar Exports

A RENEWED dollar export drive and reconstituted Dollar Exports Council to direct it were announced last week. It will be remembered that the former Dollar Exports Board ceased to function last June and was replaced by an Advisory Council, which, as its name implied, had advisory powers only. Since then, however, the dollar situation has worsened and a new organisation has been found necessary to cope with the problem.

Some of Britain's prominent industrialists, among them, Sir Charles Colston, chairman of Hoover, Ltd., and Sir John H. Woods, director of English Electric Co., Ltd., have joined the new Council, comprising 17 members under the chairmanship of Sir William Rootes. For the direction of day-to-day work in this country an executive committee has been formed, and a Chief Executive is to be appointed shortly. The Executive's office will be at 41, Buckingham Palace Road, London S.W.1 (Tel.: Whitehall 6711). To ensure co-ordination of policy and effort on both sides of the Atlantic, leading businessmen in Canada and the U.S. have been appointed as Overseas members of the Council. Mr. James Duncan, president of Canadian Dollar-Sterling Trade Advisory Council, and Sir William Wiseman, will be chairmen of the Canada and U.S. groups, respectively.

New Prices for Non-ferrous Scrap

AN order bringing secondary unwrought copper under price control and reducing the controlled prices of secondary copper alloys, was made last week by the Minister of Supply. It is entitled: Non-Ferrous Metals Prices (No. 9) Order—S.I. 2174 1951, and became operative as from December 12. Copper prices will be equivalent to the Ministry of Materials' selling prices for virgin copper and in order to allow production of refined copper at these prices, those of copper scrap have been reduced by £8 a ton. Copper alloy scrap prices are being reduced in proportion to the copper content. Provision has been made to allow the completion of contracts already entered into at the higher prices.

The new prices of secondary unwrought copper range from £224 and £225 10s. for ingot bars, wire bars and cathodes, to £200 for all other types and specifications. Reduced prices for brass range from £219 to £235, for copper scrap from £166 to £202 and for brass scrap from £164 to £197.

Intensified Scrap Drive

FOLLOWING discussions between the Minister of Supply, the steel industry and scrap merchants, it has been decided to intensify the campaign for saving scrap iron and steel during 1952. Officials in the appropriate organisations for the saving of scrap metal are at present investigating methods of making more effective the existing campaign which was undertaken early this year by the iron and steel and scrap merchants industries. A similar appeal to save brass, bronze, lead and zinc scrap was made by the National Association of Non-Ferrous Scrap Metal Merchants last October.

Wiring Inspectors Exonerated

ALLEGATIONS that the N.W. Electricity Board had condemned wiring which had turned out to be their own, and then changed their minds when the fact was discovered, have been refuted by Mr. G. A. Robertson, manager of the Board's No. 4 subarea. The installation inspection department, he said, was an entirely separate entity from the wiring department and inspectors had strict instructions to apply exactly the same standards of examination to wiring carried out by the Board or by private contractors. In fact, he added, inspectors were inclined to be more critical of the Board's installations than those carried out by private firms. Mr. Robertson said he had found no evidence to support the allegations, but would welcome any substantiation of such an incident.

Tariffs—a Particular Case

THE special case of commercial and industrial tariffs at Ashford (Kent) was mentioned at last week's meeting of the S.E. Consultative Council. A new tariff was to have been introduced to the district last July and previous charges and all flat

The First Half-Century

There is nothing inherently impossible in the statement so confidently made by Mr. Marconi that he has succeeded in signalling by wireless telegraphy across the Atlantic: at the same time there is nothing that need alarm the cable companies, for the present at any rate. Hardly anything could be more foolish than the conduct ascribed to the Anglo-American Telegraph Company in threatening Mr. Marconi with an injunction should he continue his experiments; and that to protect a monopoly that has but two years to run. Nothing could be better advertisement for Mr. Marconi or do more to depress submarine shares.—*From our issue of December* 19, 1901.

rates withdrawn simultaneously. Representations were made giving many instances where the new charges coupled with the withdrawal of the old and any alternatives produced huge increases—in some cases as much as 200%. There were also a number of anomalies, it was stated, particularly as many consumers had prior agreements which had to be honoured. The Board decided to reinstate the old charges and alternative flat rates, at the same time leaving the new one for those who might benefit.

A complaint from a Brighton Hotel alleging that "ring" lamps were below standard, was also raised. This matter was referred to the chairman for inquiry. There was some doubt as to whether it came within the duties of the Council, and in any case, it was felt there was insufficient evidence in support of the allegation.

Engineers in the Welfare State

ENGINEERS, by virtue of their position and training can play a dominating part in the building of the new society which is slowly taking shape. This was the theme of MR. R. F. MATHIESON when he presented a paper, "The Engineer in the Welfare State", last week, to the A.S.E.E. in London. He suggested that the engineer would hold a key position in such a society, whether or not he helped in its formation. In the rest of his paper he dealt largely with the problem of productivity, and the related subject of incentives.

Equipment on Cornwall Coast

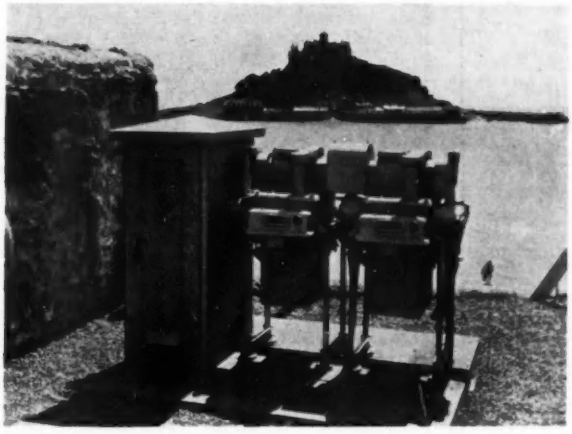
VISITORS to picturesque St. Michael's Mount, Cornwall, next summer, might come upon the equipment guarding the supply of electricity to the small island across Mounts Bay. The 830 yd feeder from the Marazion substation of the S.W. Electricity Board is controlled by a Crompton Parkinson "T.A.P." 100 MVA breaking capacity, automatic-fuse oil circuit-breaker unit. This is lined up with a similar unit, controlling a local transformer, and a metering kiosk. The "T.A.P." units have compound-filled busbar chambers, and have been designed to withstand severe weather conditions.

"There is always time for leisure when you use Hotpoint appliances" is the theme of this Christmas window display to be seen at Hotpoint's London offices. A number of that company's appliances have been included in a corner of the modern kitchen which looks out on to a typical winter setting

Training in the Smaller Firm

SPECIAL attention to the problems of selecting and training technical and managerial employees for firms of total payroll of 300 and less is given in a recent publication of the British Engineers' Association. This pamphlet bears the title: "Selection, Training and Education for Technical, Supervisory and Managerial Staffs in the Engineering Industry" and covers the full field that this suggests, reviewing many recent statements on this topical problem. The special section referred to has value in relation to this wider survey, and is likely to be welcomed as an essay into a field not commonly tackled.

Some useful appendices include an outline training schedule for technicians, typical forms for use in a scheme, and a list of bodies connected with training for industry. Copies are obtainable from 32 Victoria Street, S.W.1, price 2s.



Switchgear controlling the 11 kV supply between St. Michael's Mount and the Cornish mainland

Inquest on Derby Engineer

A VERDICT of death from misadventure was recorded at Derby last week at the inquest on a shift engineer who was killed in an explosion at Derby power station on November 5. Mr. H. Topley, station superintendent, told the coroner that he thought the accident occurred because of an error of judgement by the deceased and a fellow worker who were transferring the load. Earlier, he said, there had

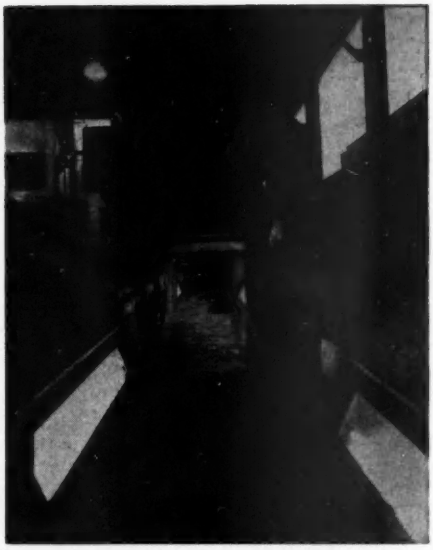
been a reduction of power due to a stoppage by leaves in the circulating water. There should have been a switch on the transformer but that particular one had been hurried into operation two years ago and the switch had been ordered, but had not arrived. Mr. Topley added that all power stations were waiting for switchgear. Electricity supply would be endangered without the use of that transformer. The coroner said one thing was certain: following the engineer's death, there would be an inquiry on a national scale into such accidents.

Advice to Engineers

PRESIDENT of the Junior Institution of Engineers for the current session, Air Commodore F. R. Banks, C.B., O.B.E., chose "Enterprise in Engineering" as the subject of his inaugural address, delivered last Friday. He devoted a considerable part of his paper to giving advice to the young engineer, suggesting that he should try first to get on the shop floor, then go to the experimental department, following with the service department to see the troubles which occur after the product has been in the hands of the user. During these two or three post-graduate years he should keep up his technical knowledge by attendance at evening class refresher courses.

Inspection Pit Lighting

AN unusual lighting installation which came to our notice a short time ago was one which involved the illumination of locomotive inspection pits at the railway sidings of the North Thames Gas Board, Beckton. One of the problems encountered was the protection of fittings from oil and water dripping down the side walls of the pits. Fittings were specially designed by the G.E.C. to overcome these difficulties. They have inclined front glasses and polished aluminium angle reflectors for directing the light. They have been



A view along one of the locomotive inspection pits at Beckton Gasworks showing the arrangement of lighting fittings, entirely protected from oil, grease and water, yet giving adequate illumination

recessed behind the face of the walls and a groove in the upper part of each concrete enclosure acts as a protection. In addition, joints have been sealed by a rubber gasket. Each fitting houses one 5 ft 80 W lamp. There are two pits in the running shed and each have been equipped with eight fittings.

OFFICIAL PUBLICATIONS THIS WEEK

NON-FERROUS METALS PRICES (NO. 9) ORDER. H.M.S.O., 4d.
S.I. 2174. *Reduces prices of secondary copper alloys and introduces controlled prices of secondary unwrought copper.* (*See page* 1140.)

BUILDING RESEARCH. H.M.S.O., 4s.
D.S.I.R. report for 1950 (*See page* 1136.)

E.R.A. REPORTS.
L/T. 244. *Borium Titanate Twinning at Low Temperatures* (6s. 3d.); M/T. 102. *Single Frequency Instrument for Measurement of Interference with TV reception due to Ignition System* (3s. 3d.); M/T. 105. *Study of Balanced Harmonics in an Overhead Ring Main System* (15s. 4d.) (*Obtainable from E.R.A., Thorncroft Manor, Dorking Road, Leatherhead*).

CODES OF PRACTICE.
CP 324.202. *Domestic Electric Water-Heating Installations* (3s.)
CP 327.402. *Staff Location Systems.* (3s.)
(*Both on page* 1136.)

Cold Comfort

THE recent cold spell has served to test the precautions taken to avoid power cuts to the full, and while low temperatures have made the lot of Britain's citizens uncomfortable, some satisfaction may be gained from the fact that the warning system for load shedding has proved effective. Severe frost last week induced the B.E.A. to warn industry and the public to be careful. The same evening, the B.E.A. was able to disprove its prediction that load-shedding would be necessary.

Load-shedding has been comparatively rare so far this winter, which fact is almost certainly due to the wide publicity campaign and to the fact that every effort was made during the summer to carry out maintenance and repair work at power stations as quickly as possible. At the same time the first use of the B.B.C. to broadcast a warning also proved satisfactory.

"Political Shuttlecocks"

THE tendency to use nationalised industries as political shuttlecocks, and unwieldy negotiating boards in the electrical industry, were subjects mentioned by speakers at the annual dinner of the East Anglian section of E.P.E.A. It was the asso-

ciation's president, Mr. I. C. Williams, who referred to the political aspect. They were perturbed, he said, by the tendency of politicians to use the industries to play with. When any party used them as political shuttlecocks members of the industry would become less and less disposed to shoulder responsibilities.

Criticism of negotiating boards was made by Mr. H. C. Waters, deputy chairman of E.E.B. The Board had to deal with a large number of unions, negotiations lacked uniformity and resulted in an overlapping of work. Sometimes, he said, as many as 40 or 60 people took part in negotiations, of which only a dozen had anything to say. The smaller the committee the better, he added.

Hoover Prize Day

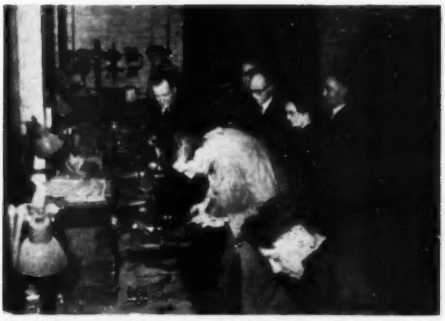
SCHOOL days were recaptured at Hoover Ltd.'s Perivale works recently when the annual Apprentice Prize-Giving was held. At the company's training school, young boys and girls from the age of 15 upwards are taken in and taught the rudiments of their jobs. Prize day sees the reward for those labours, and on this occasion nearly 50 young persons received certificates and prizes. Dr. F. A. Freeth, of the Central Staff Dept. of I.C.I., Ltd., was the guest speaker and presented the awards.

Official Visitors at Foundry

DISTINGUISHED guests at the Black Lake foundry of Alfred Ellison, Ltd., were the Mayor and Mayoress of West Bromwich. Led by the foundry manager, Mr. A. V. Shanks, and production manager, Mr. S. Poulton, they saw all stages in the production of castings, a large proportion of which were for electrical equipment made by the parent company. The visitors were much impressed by the appearance of the works, both inside and out.

Y.E.B. Case and Income Tax

LITTLE reference was made at last week's meeting of the Yorkshire Electricity Consultative Council to the recent court proceedings against the Board. One member asked whether the public would be informed of what took place at the Minister's meetings with the board. The chairman pointed out that details had been given in Parliament and published in Hansard. It may be significant that Y.E.B.'s accountant told the Council that financial results over the past three years bore comparison with any other Board. Total fixed assets up to March 31 were £58,500,000. Now that nationalised industries were liable to income tax, a sum of £3,500,000 had been adjudged representative of year's liability over the whole country. Amount allocated to Y.E.B. was £310,000.



The Mayor and Mayoress of West Bromwich watching craftsmen at work in the pattern repairs and maintenance shop during their visit to Alfred Ellison, Ltd.

The Mayor of Southampton, Clr. Mrs. M. Cutler, speaking at the inauguration of grit and dust collection plant at Southampton power station. With her on the platform (from right to left) are Mr. R. H. Coates, Southern Divisional Controller, Mr. Cutler and Mrs. Coates. The new plant serves four of the six older boilers and will be connected to the others eventually

Sales Conference and Dinner

SALES conferences these days may be said to have increased in importance over their pre-war counterparts. That of the Electric Construction Co., Ltd., held a short time ago afforded an opportunity for discussions on such present-day problems as shortages of copper, sheet steel and bearings. Talks ranging over two days covered prospects for all the company's products, and were attended by representatives from all over Britain, as well as the company's representative in New Zealand. The final evening was marked by the firm's annual dinner attended by some 200 members of the staff past and present.

Greetings for 1952

IT seems no time at all since we were the happy recipients of greetings and calendars for 1951, yet similar good wishes for 1952 have been arriving in the office and we take this opportunity of acknowledging and returning those greetings. At home, Brook Motors, Ltd., have reproduced drawings by Joseph Pike of scenes and historic buildings in Yorkshire, to enhance their calendar, and from B.I.C.C. has come a plain yet useful production giving the current, previous and following months in full, as well as columns for 1952, 1951 and 1953. From across the Channel a beautifully illustrated calendar has reached us from Ateliers de

Constructions Electriques de Charleroi, Belgium, showing reproductions of old paintings which feature the country's folk lore. From Belgium to Holland is but a short step and the Economic Department of the Royal Netherlands Embassy have sent a calendar depicting the life and traditions of their country through the medium of paintings and modern photographs.

Japanese Competition

SPEAKING at a meeting of the Institute of Export last week, Mr. D. Maxwell Buist, export director of B.E.A.M.A., said British workmanship was no longer better in capital goods than that of the Americans, Germans, Swiss, Italians or, in some cases, the Japanese. British craftsmanship was still supreme in hand-made goods and we would have to rely on that and inventiveness in establishing new industries.

Instancing the competition in Britain's traditional markets, Mr. Buist said the Japanese were the world's biggest copyists. In China, one could see hydro-electric and steam electrical generating plant which appeared to be the product of British or U.S. companies, but which in fact were Japanese-made. On the Yalu River there were eight Japanese 100,000 kW turbo-alternator units, bigger than any generating set made in Britain and as big as the largest in America. They were exact copies of American plant.

Lessa Concert

THE leisure activities of Britain's working population have been the subject of research work by many learned institutions and, undoubtedly, the range of interests is so wide as to present an ideal and absorbing subject for study. Last week we ventured into this business in our own humble way when at the kind invitation of the Lessa Music Society we attended a choral and orchestral concert presented by members.

Under conductors Leslie Atkins and Fred Stevens the orchestra made a spirited attempt at an ambitious programme which pleased the audience immensely. The choral works were indeed worthy of praise. Much time had obviously been spent in rehearsals and the excerpt from Handel's *Messiah*, "For unto us a child is born," was as appropriate in its choice as excellent in its execution. Margaret Wilby, the solo soprano, gave an admirable performance.

NEWS IN BRIEF

A new showcard displaying a few examples of plastic insulated wires and cables, has been produced by J. Day and Co., Ltd., and is available to radio and electrical wholesalers.

Total paid attendance at the Smithfield Show and Agricultural Machinery Exhibition at Earls Court was 65,903. This was an increase of 16,522 on last year and an all-time record.

Special small transformers built by Foster Transformers and Switchgear Ltd. (one of Lancashire Dynamo Cos.) were used for remote indicating purposes with arrestor equipment on the Navy's latest aircraft carrier, H.M.S. *Eagle*.

E. K. Cole, Ltd. are holding a Christmas party for some 600 children at Harringay on Saturday.

Electric Supply News

Amesbury

The parish council is complaining that the Amesbury Rural Council has wasted ratepayers' money by taking the electricity connections to the new Holders Road estate to the backs of the houses instead of erecting overhead mains in the roadway to allow the Parish Council, as the lighting authority, to install the street lamps required. At the parish council meeting it was pointed out that the Southern Electricity Board had estimated that to provide street lighting on 16 poles would now cost about £400; or £900 if underground mains were used. It was agreed to seek early co-operation with the rural council on such matters in future.

Buckie

A 150 h.p. diesel-driven set, one of five at Buckie power station which have become redundant as a result of the town's changing from d.c. to a.c., has been despatched to a purchaser in Pakistan. The engine was installed at Buckie about 12 years ago.

Horbury

The Urban District Council has been told by the Yorkshire Electricity Board that because of severe limitations of capital, it cannot provide more than 300 gas-lit council houses with electricity as proposed by the Council.

Newton Abbot

A petty argument between the local Rural District Council and the South Western Electricity Board over the rental of a site for a substation to serve new houses on a Kingsteignton estate is causing some bitter comments locally. The Board offered a nominal rental of 1s. per year, but the Council is demanding 10s., apparently, and while these two authorities cannot resolve the matter, oil lamps have to be used in the houses concerned.

Orpington

At a recent meeting, Orpington Council accepted an offer of the South Eastern Electricity Board amounting to £2,595 for mains and services to the new Chelsfield estate of 222 houses. The Board's offer, some £4,000 lower than a previous estimate, contained the proviso that the Board should be given the names of the proposed tenants so that they could be canvassed to try to persuade them to have electric equipment such as cookers installed.

Isle of Man

Under a five-year plan 383 Manx farms and 240 farm workers' houses have been wired for electricity. During the next three years £74,000 have been earmarked for the work.

LIGHTING SCHEMES

Northampton.—The Highways and Cleansing Committee has approved a scheme for electric street lighting on Group "A" and "B" roads in the town, based on a quotation submitted by the East Midlands Electricity Board. The cost of provision and erection of 252 fluorescent and 848 tungsten lamps is £39,360. It is also proposed to convert from gas to electricity 200 lamps in the vicinity of the town centre at a cost of £3,000.

St. Asaph.—The parish council has approved the conversion of street lighting to electricity at a cost of £2,389.

Stockport.—Fifty streets will be covered in the second stage of converting street lighting from gas to electricity in Stockport, at a cost of £22,540.

Warrington.—At a cost of £8,500, the T.C. plans to improve the standard of street lighting of Winwick Road, Parker Street, Mersey Street, Church Street, Manchester Road and Padgate Lane.

Company Activities

Joseph Lucas Ltd.

The consolidated surplus, after taxation and certain deductions (but not depreciation), for the year to July 31 is £1,609,032 (*£1,359,474*). Taxation absorbs £3,802,780 (*£3,581,388*). To depreciation £598,075 (*£579,059*) and supplementary pensions £150,000 (*same*), and the net profit of Joseph Lucas, Ltd. is £928,297 (*£828,362*). Of this £500,000 is transferred to reserve, £60,000 to funds for benefit of employees, and £370,879 is carried forward.

Palestine Electric Corporation Ltd.

A public issue was made in Israel last week of 600,000 Ordinary shares of £1 sterling each, at 30s. each per share.

Plessey Co. Ltd.

The consolidated balance sheet shows fixed assets listed at £1,319,431 (*£996,832*), plus small lots and trade investments at £56,401 (*£35,339*). Current assets amount to £3,385,043 (*£2,562,672*), of which stock and work in progress accounts for £2,221,811 (*£1,490,517*). Current liabilities and provisions total £1,519,082 (*£980,494*). Mr. A. G. Clark, the chairman, states that output is running at well over £10,000,000 per annum, and today, the firm is producing a greater volume and a larger variety of products than ever before. Manufacturing activities based on development and research in electro-chemical products has been extended. Expansion of activities has justified the opening of a new factory in Northamptonshire which will come into production during the current year.

Scottish Cables Ltd.

Following the increase in the authorised share capital at the annual general meeting last August, the directors have decided to issue 208,335 Ordinary Shares of 4s. each at 17s. 3d. per share to Stockholders in the proportion of one new share for every six Ordinary Stock Units of 4s. each held. The new shares will, when fully paid, be converted into stock ranking in all respects *pari passu* with the existing Ordinary stock and carrying the right to Dividends which may be declared in respect of the financial year ending April 30, 1952. The issue has been underwritten by Helbert, Wagg and Co.

Tube Investments Ltd.

The Electrical Division, by seizing opportunities and developing new activities, had achieved a record year in a competitive field, thus offering a welcome foretaste of the results we may reasonably expect with the removal of the manufacturing restraints that the national shortage of electric power has placed upon this long-frustrated industry, declared Mr. I. A. R. Stedeford, chairman, at this meeting last week. This would assuredly be done at the first opportunity, he explained, but even so, it must be several years at the earliest before householders would again be allowed to experience that electrical bliss which the complete range of Creda products would provide. Commenting on the company's expanding overseas interests, he referred to the good progress made by the South African concerns, where the new factory for the manufacture of Simplex electrical equipment by Southern Engineering Supplies, Ltd., will shortly be completed, and in production by early spring, it is hoped. Both the Steel Tube and General Engineering Divisions had acquitted themselves well, although the stoppage of tube steel imports early this year produced a serious situation, with some short time working at factories. But following representations, official assurances had been given that the situation would be corrected. The new large rolling mills of the South Wales Aluminium Co. was started on their first trial runs a few months ago, but the 1952 allocation of aluminium is less than one-tenth of what the mills need, he stated.

Dividends Declared

British Insulated Callender's Cables.—Interim of 2% (*same*), payable on January 21.

Brecknell, Munro and Rogers.—Final dividend of 22½% (*same*), making 32½% for the year (*same for previous 11 months*).

Burgess Products.—Dividend of 22½%.

Pinchin Johnson and Associates.—Interim dividend of 7½% (*same*).

Commercial Information

CONTRACTS OPEN

HOME

Dec. 22.—Drumquin (Co. Tyrone). Electrical heating and lighting in St. Patrick's church and hall. John O'Kane, secretary, parish committee, Drumquin.

Dec. 22.—Newport (I.o.W.) T.C. Supply and erection of 14 group B 100 W electric lamps with concrete columns on Pan estate. Borough Engineer, 39 Quay Street.

Dec. 24.—Morecambe and Heysham T.C. Electrical installation in six bungalows on Trumacar Lane estate. Borough Surveyor, Town Hall. Deposit £1.

Dec. 28.—Morpeth. Electrical installation in 56 houses in Spelvit Lane. F. K. Perkins, Borough Surveyor, 36 Bridge St.

Dec. 29.—Cork T.C. Supply of an 8-in. electric bench grinder and a portable electric bench sanding machine, all motors for 3-phase 380 V 5 c/s a.c. Philip Monahan, City Manager and Town Clerk, City Hall.

Dec. 31.—Cambridge. Electrical work in Queen Edith's Way primary schools. City Engineer and Surveyor, The Guildhall. Deposit £2 2s. (See Dec. 13 issue.)

Dec. 31.—Dalkeith T.C. Installation of sodium lighting along part of trunk roads A68 and A7. Burgh Surveyor, Municipal Buildings.

Dec. 31.—Manchester. Electrical installation at Moss House school, New Moston. City Architect, Town Hall. Deposit £1 1s. (See Dec. 13 issue.)

Dec. 31.—Newhaven U.D.C. Installation of electricity in 58 existing houses. Engineer and Surveyor, Council Offices, Fort Road.

Dec. 31.—Southgate T.C. Supply of castings (lamp columns, etc.) included in list of requirements during year ending March 31, 1953. J. T. W. Peat, Borough Engineer and Surveyor, Southgate Town Hall, Palmers Green, N.13.

Dec. 31.—Staffordshire. Fire Brigade requires supply of electric handlamps. Chief Fire Officer, Brigade H.Q., Pirehill, Aston, Stone.

Dec. 31.—Wrexham T.C. Electrical installation to 110 dwellings. Borough Engineer and Surveyor, 31 Chester St. Deposit £1 1s.

Jan. 1.—Luton T.C. Electric wiring in 136 houses, and installation of electrical services, wiring and equipment in six blocks of flats. Separate contracts. Borough Engineer, Town Hall. Deposit £2 2s. for each contract.

Jan. 1.—Stourbridge. Manufacture, supply and erection of electrically operated centrifugal pumping plant, including electric motors, switchgear, wiring, etc. Geo. P. Deeley, 13 Church St. Deposit £5 5s.

Jan. 2.—Leeds. Supply and erection of an electrically driven centrifugal pump. General Manager and Engineer, Waterworks Dept., Civic Hall.

Jan. 2.—Wandsworth B.C. Electric lamps included in list of supplies for year beginning April 1, 1952. R. H. Jerman, Town Clerk, Municipal Buildings, S.W.18.

Jan. 4.—Belfast. Supply and erection of (a) one 7½-ton and one 5-ton overhead travelling crane, one electric lift (2000 lb capacity), workshop machinery and equipment, self-contained transport weighbridge; and (b) lighting, heating and auxiliary power installations; for harbour power station. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. each item. (See Nov. 22 issue.)

Jan. 4.—Belfast. Supply and erection of complete coal-handling plant for Victoria power station, conveyors, automatic weighers and all ancillary equipment. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. (See Nov. 8 issue.)

Jan. 4.—Belfast. Supply and erection of two complete sets of condensate chemical treatment plant for turbo alternators at Victoria power station. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. Also supply of sundry items in list of annual stores including switchgear, time switches, static transformers, street lighting equipment, overhead line materials, cables, cookers, etc. Documents from Electricity Dept., East Bridge St., Belfast. Fee, 10s. (Both were advertised in Dec. 6 issue.)

Jan. 5.—Dagenham T.C. Electric lamps and supplies included in list of requirements for year beginning April 1, 1952. Borough Engineer and Surveyor, Civic Centre.

Jan. 5.—Salford. Supply of following for year beginning April 1, 1952: (a) 140 W sodium lanterns and ancillary equipment; (b) 400 W mercury lanterns with same; (c) time switches with spring reserve; (d) 25ft concrete columns; and (e) 16ft. concrete columns. Street Lighting Superintendent, Street Lighting Dept., Salford 3.

Jan. 7.—Selkirk T.C. Supply and erection of mercury lighting, comprising 31 lighting points, to Group A standard, along approx. 1,135 yd. Burgh Surveyor, Municipal Buildings.

Jan. 8.—Poplar B.C. Supply of electric lamps wanted for year beginning April 1, 1952. Town Clerk, Town Hall, Bow Rd., E.3.

Jan. 9.—Hepton R.D.C. Supply and installation of 31 lanterns, lamps, control gear and steel standards for Group A lighting on trunk road A646 at Charlestown, Yorks; also for supply of 11 lanterns, lamps, control gear and brackets; 140 W sodium lamps to be used. Surveyor to Council, District Bank Chambers, Hebden Bridge. Deposit £2 2s. (See Dec. 13 issue.)

Jan. 11.—Manchester. Electrical installation in home for aged persons, Nuthurst Rd., Moston. City Architect, Town Hall. Deposit £1 1s. (See Dec. 13 issue.)

Jan. 12.—Galway. Supply and installation in pumphouse of two direct-driven horizontal centrifugal pumps and two electric motors with all necessary accessories. C.C.'s consulting engineer, E. R. Ryan, 1 Montpellier Terrace, Galway. Deposit £5 5s.

Jan. 14.—Aireborough U.D.C. Supply and installation of (a) columns and brackets, and fit-

ting and wiring of lanterns, and (b) supply of lanterns and all auxiliary gear; for 250 W mercury discharge lighting along 2½ miles of Leeds Rd. Engineer and Surveyor, Council Offices, Micklefield House, Rawdon, nr. Leeds. Deposit £2 2s. (See Nov. 15 issue.)

Jan. 14.—Wallasey T.C. Electrical installation in Mount Rd. and Park county infants' schools. Borough Architect, Town Hall. Deposit £1 1s.

Jan. 21.—East Retford R.D.C. Supply and erection of electrically driven borehole pumping plant at Everton pumping station. Names to Council's Consulting Engineer, John H. Haiste, 4 Queen Sq., Woodhouse Lane, Leeds 2.

Jan. 21.—Ealing T.C. Lamp columns included in list of supplies needed for year ending March 31, 1952. Borough Engineer and Surveyor, Town Hall, Ealing W.5.

Jan. 22.—Edinburgh. Supply and erection of water turbine and 80 kW alternator with necessary wiring and switchgear at Fairmilehead Filters. City Water Engineer, 6 Cockburn St.

Jan. 31.—Norwich. Supply and erection of two sets of electrically driven vertical spindle centrifugal foul sewer pumps and ancillary equipment. City Engineer, City Hall. Deposit £5.

Feb. 1.—Ireland. Supply and erection of hydro-electric generating plant at Inniscarra and Carrigadriod stations on River Lee. Documents from Chief Generation Engineer, Electricity Supply Board, 27 Lower Fitzwilliam St., Dublin, Deposit £5 5s. (See Nov. 1 issue.)

Feb. 11.—Manchester. Electrical installation at Crab Lane county school, Blackley. City Architect, Town Hall. Deposit £1 1s. (Advertised in this issue.)

No date stated.—Midlothian. Supply of 94 electric cookers and 94 electric wash boilers for West Calder housing scheme. County Architect, 32 Palmerston Place, Edinburgh 12.

No date stated.—N. of Scotland H.E. Board. Supply and erection of approximately 47 miles of 22 kV, 10 miles of 11 kV, and 30 miles of l.v. single-circuit wood pole overhead transmission and distribution lines in islands of Benbecula, S. Uist and Eriskay. Engineers, Merz and McLellan, 39 Northumberland St., Edinburgh 3. Deposit £1 1s. (See Nov. 22 issue.)

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Jan. 14.—New Zealand. Supply of twenty 300 kVA 3-phase transformers of double wound core type, self-cooled oil-immersed outdoor type, suitable for 6,600 V system to give 415 V between phases on secondary side. Auckland Electric Power Board, Queen St. B.o.T. (Ref. CRE (IB) 77163/51).*

Jan. 14.—Uruguay. Usinas Electricas y Telefonos del Estado, Montevideo, requires four to six steam generators, normal minimum capacity, 20,000 kgs/hr and maximum overload capacity 28,000 kgs/hr. B.o.T. (Ref. CRE (IB) 75489/51).*

Jan. 15.—India. Supply of two all-electric full-revolving cranes for Maithon Dam, Bihar. Power available is 3-phase, 50 c/s, 400 V. Purchase Officer, Damodar Valley Corporation. B.o.T. (Ref. CRE (IB) 76631/51).*

Jan. 17.—South Africa. Supply of two 25-ton, two 40-ton and one 7-ton overhead electrical travelling cranes for S. African Railways. Chairman of Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (Ref. CRE (IB) 77515/51).*

Jan. 28.—Greece. Supply of complete trunk exchange installation for Athens. Telecommunications Reconstruction Procurement Committee, Ministry of Communications, Argentinis Str 4, Athens.

Jan. 30.—Tangier. Supply and erection of fluorescent lighting scheme along seven streets. Major requirements are 3-phase time switches and meters in transformer station; feed voltage of l.t. circuit 200/115 V; and each unit to be fitted with circuit breakers. L'Ingenieur Directeur de la Regie des Services de l'Eau et de l'Electricite, 4 rue Vermeer, Tangier. Deposit 1,500 francs. B.o.T. (Ref. CRE (IB) 77053/51).*

Feb. 20.—S. Rhodesia. Electricity Supply Commission invites tenders for two high efficiency water tube boiler units capable of evaporating 100/120 thousand lb. water per hr. for Umniati B station. Commission is at P.O. Box 377, Salisbury. B.o.T. (Ref. CRE (IB) 76916/51).*

Feb. 22.—Brisbane. Supply of thirty-six 300 kVA and thirty-six 200 kVA three-phase 10,500 V Delta to 430/248 V Star, no load, step down, outdoor distribution transformers with oil and h.t. cable boxes. City Hall, Brisbane. B.o.T. (Ref. CRE(IB) 76904/51)*.

Feb. 27.—S. Rhodesia. Tenders invited for two high efficiency water tube boiler units capable of evaporating 50,000/60,000 lb water per hr for Shabain No. 2 station, by Electricity Supply Commission, P.O. Box 377, Salisbury. B.o.T. (Ref. CRE (IB) 76916/51).*

Feb. 29.—Johannesburg. Electricity Dept. invites tenders for

Your Queries — Answered

"Anglow" fires, makers of? T.E.—C. Thompson, 243 Heigham St., Norwich. (23197)

"Itonia" irons, repairer of? W.E.—H.Chapman, 71 Goldworth Rd., Woking. (22206)

Refrigerator with a deep-freeze compartment, makers of? A.B.—Deepfreeze Refrigeration, Ltd., 193 Baslow Rd., Totley, Sheffield. (22215)

"Pernax" cables, makers of? R.T.—These were made by British Insulated Callender's Cables, Ltd., Bical Hse, Bloomsbury St., W.C.1, but are no longer being manufactured. (22224)

"Ramset" guns and similar devices, agents and manufacturers of? F.M.—John Radon, 46 Kendal St., W.2.; F. H. Bourner & Co. (Eng.) Ltd., Carlton Rd., South Croydon, Surrey; Adam and Harvey, Ltd., 9/10 Tokenhouse Yd., E.C.2. (22236)

The above are selected from questions we have answered this week. If you have a query, send it to us.

supply and erection of (a) six stoker-fired water tube boiler units; (b) three 30,000 kW C.M.R. turbo-alternators with auxiliary apparatus; (c) three sets of condensing plant for above; (d) one 180,000 lb. overhead electric travelling crane, one 43,000 lb. crane and one 27,000 lb. crane. Separate contracts. Documents from the Dept. at Room 19, Head Offices, President Street West, Johannesburg. Deposit £5 5s.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at time of going to press)

	£ s. d.	New York price
COPPER, electrolytic	227 0 0	£220 0 0
LEAD, good soft pig (foreign)	175 0 0	152 0 0
,, ,, ,, "English" quality ...	176 10 0	
TIN (99·99·75%) ... ... (Cash)	922½-925	—
,, (3 months)	922½-925	—
ALUMINIUM, commercial purity (del.)	124 0 0	—
ZINC	190 0 0	156 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	55 5 0	—
Mild Steel Tape (0·04 in.)	32 5 0	—

CONTRACTS PLACED

Berwickshire. Provision of 48 street lighting points in three districts, S. E. Scotland Electricity Board.

Bolton T.C. Repairs and improvements to lighting at Tonge Fold secondary school, N.W. Electricity Board.

Coventry. Electrical installations in Richard Lee primary school, H. Tansey, £3,077; same at Training College, Clifton Electrical Services Ltd., £2,600; and in 108 houses on Manor House estate, Clifton Electrical Services Ltd., £3,424. Also supply of following in first stage of conversion from gas to electricity: 100 small lanterns, choke coils and capacitors, G.E.C. Ltd., £6,429, and of 1,000 swan-neck brackets, A. C. Ford Ltd., £2,938.

Hartlepools. Lighting in extensions to factory of J. B. Pillin Ltd., on trading estate, N. of England Engineering and Electrical Co. Ltd.

Lewisham B.C. Provision of 200 consumer supply control units, Mantel Metalworkers, Ltd., £1,155.

Maidstone T.C. Rewiring and replacing all electrical fittings in 34 houses in Queen's Rd., Horton and Childs Ltd., £1,536.

Middlesex. Lighting installation at Enfield tech. college, Watson and May Ltd., £1,526.

Northumberland. Electrical installation in county library at Morpeth. A. Haggerty, £1,824.

North Riding. Electric re-wiring of part of county hall, Northallerton, Hardisty and Nelson.

Norwich. Installation of street lighting in Farrow and Guardian Rds., Eastern Electricity Board, £1,813.

Oswaldtwistle U.D.C. Conversion of street-lighting from gas to electricity, N.W. Electricity Board, £2,941.

Rotherham T.C. Renewal of 5¼ miles of cadmium copper trolley wire, British Insulated Callender's Cables Ltd., £2,108.

Shepshed (Leic.) U.D.C. Wiring of 56 houses, M. and W. A. Smithers, £2,304.

South Shields T.C. Supply of 92 horizontal lanterns. Engineering and Lighting Equipment Co., Ltd. £1,516.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Hivac. 685,453. Class 9. Thermionic valves, cold cathode tubes and suppressor tubes for telephone and telegraph lines. Hivac Ltd., Greenhill Crescent, Harrow-on-the-Hill.

Igloo. 698,934. Class 11. Refrigerators, freezing and cooling machines, storing cabinets, etc. Igloo Ltd., Cunliffe Rd., Park Road Corner, Blackpool.

Rotavisor. 701,511. Class 9. Apparatus for displaying sequences of still pictures recorded on photographic film. Newton and Co. Ltd., 72 Wigmore St., London, W.1.

Tanaura. 698,975. Class 11. Lighting fittings. Teeanee Ltd., Berkeley Works, Berkeley Rd., N.W.1.

Tela, with design. 691,237. Class 7. Conveyors, generators, motors, dynamos, etc. 691,239. Class 9. Wireless transmitting and receiving apparatus, electro - acoustic apparatus, etc. Tesla, Narodni Podnik, 7 Karlovo Nam, 11 Praha, Czechoslovakia.

Trav Sound (in design). 701,232. Class 9. Tape recorders. T. H. Products, 92 Leathwaite Road, Battersea, S.W.11.

Wefco. 693,207. Class 9. Nautical, signalling and navigation lights, testing apparatus, etc. Watts, Fincham (1932) Ltd., 9 St. Helen's Place, E.C.3.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Hartog Electric Lighters, Ltd. Resolution for voluntary winding-up passed at meeting on Nov. 29. At subsequent meeting of creditors Charles McAuley, 781 Salisbury House, London, E.C.2, was appointed liquidator. Creditors are asked to send particulars to the liquidator by Dec. 31.

Release of Liquidator

Stourbridge. Mansfield Maxton, Ltd., electric motor manufacturers of Hayseech Works, Halesowen. Liquidator was Rudolf Kynoch Clark, Official Receiver, Somerset House, Temple Street, Birmingham.

TRADE NOTES

Canadian Acquisition. The Brush Electrical Engineering Co. Ltd. has acquired a 31% interest in Diesel Equipment Co. Ltd. of Vancouver. One of the main functions of this concern will be the selling of large Diesel engines, mainly marine, and generating sets manufactured by Vivian Diesels and Munitions Ltd. and Vivian Engine Works Ltd., the two Brush Aboe Group subsidiaries with factories in Vancouver. These two factories manufacture engines of 35-600 b.h.p. and generating sets of 20-400 kW.

Sole Agents. The Truvox Engineering Co. Ltd. have appointed J. W. Equipment Ltd., 3a Berkeley Place, Clifton, Bristol, as their sales agents covering Dorset, Somerset, Wiltshire and Gloucestershire, and Mr. D. Annibal, 2 Rydal Mount, Chestnut Grove, Gedling, Nottingham, as their sales agent covering Nottinghamshire, Derbyshire, Lincolnshire (excluding the Soke of Peterborough).

BUSINESS PROSPECTS

HOME

Alcester (War.) R.D.C. Eighteen houses to be built at Studley, 16 at Alcester and Bidford-on-Avon, 8 each at Broom and Wilmcote, 4 at Gt. Alne, 2 each at Exhall and Wixford.

Alston (Cumb.) R.D.C. Plans prepared for development of Grisedale Lane site.

Ammanford U.D.C. Construction of 64 houses and 12 flats on Bishop Rd. estate. M. R. Gethin, Engineer and Surveyor, Council Offices.

Baildon (Yorks) U.D.C. Construction of 10 shops, 8 houses and a flat at Shopping Centre on Knoll estate. Architects are William Illingworth and Son, 15 Sunbridge Rd., Bradford.

Belfast. Plans approved for erection of a block of 28 flats on Flushpark estate; also for 65 flats in Antrim Rd.

Birmingham. It is proposed to adapt "Wyddrington" to judge's lodgings at cost of £45,710; also repairs and alterations at Aston Hall and Lodges costing £59,587.

Bucklow (Cheshire) R.D.C. Construction of 73 houses on two sites. H. V. Shaw, Engineer and Surveyor, 26 Station Bldgs., Altrincham.

Cardiff. Erection of county primary school at Llanrumney. City Surveyor, City Hall.

Colchester. T.C. has received an allocation of 120 houses for first six months of 1952; also approval sought for a scheme to build 8 bungalows at estimated cost of £9,765.

Colwyn Bay T.C. A total of 72 houses, 27 flats and 6 bungalows are to be built on Glyn estate.

Cudworth (Yorks) U.D.C. Erection of 36 dwellings on various sites. J. Hinchliffe, Engineer and Surveyor, Council Offices, Barnsley Road.

Dumfries T.C. It is proposed to build 620 houses on a site at Lochside Farm.

Dundee. Shell Mex and B.P. Ltd. intends to build oil depot at Stannergate.

Eastbourne. C. F. Baker has been appointed quantity surveyor for erection of factory on Brampton Rd. estate for Armour and Co., Ltd.

Folkestone T.C. Campbell, Norris and Co. propose to build a factory in Wear Bay Rd.

Golborne (Lancs) U.D.C. Application to be made for sanction to borrow £41,628 for erection of 30 houses for miners in Derby Rd. estate.

Gt. Yarmouth T.C. A primary school is to be built at Lawn Ave. Tenders to be invited shortly for construction of hostel at Caister Rd.

Hepton (Yorks.) R.D.C. New housing estate being planned at Heptonstall.

Hertford T.C. Erection of public hall on Horns Mill estate. Bills of quantities from E. C. Harris and Partners, 3 Bedford Sq., W.C.1.

Leamington Spa T.C. Erection of block of flats in Tachbrook Rd. Architects are Rayner and Fedeski, 28 The Parade.

Leyton. Approval granted to Copeland and Jenkins, Ltd., for extensions to their offices in Church Rd.

Luton T.C. Tenders expected to be invited shortly for erection of six blocks of flats (72) on Farley Hill estate. Plans in hand also for 62 houses in Putteridge Rd. for Kingsway Housing Association, Ltd. Council has received an allocation of 250 houses for first six months of next year.

Lutterworth (Leic.)R.D.C. Erection of a total of 40 houses on five sites. Surveyor, Council Offices, Lutterworth, near Rugby.

Maidstone T.C., Tenders to be re-invited for rewiring and replacing all electrical fittings in 34 houses in Queen's Rd.

Manchester. Erection of divisional police station at Hall Lane, Wythenshawe. City Architect, Town Hall. Council recommended to approve rewiring of electrical circuits at Central Gallery. Estimated cost £1,500.

Newcastle - under - Lyme T.C. Bournville Architect is to be asked to prepare plans for erection of shops on Bradwell and Clayton estates.

Okehampton T.C. Erection of 20 houses and 12 flats on Savile Mead estate. R. Alan Brunskill, Borough Engineer and Architect, Municipal Offices, Market Street.

Ongar (Essex) R.D.C. Community centre and group of shops have been proposed for Shelley estate.

Plymouth. Approval sought for expenditure of £88,495 on Whitleigh No. 2 primary school; also for erection of Pennycross primary school costing £51,456.

Renfrewshire. Approval given for erection of school at Paisley and adaptation of two schools at Greenock.

Shardlow (Derby) R.D.C. Approval granted for erection of 240 houses on various sites including 28 at Chaddesden, 24 at Sandiacre, and 22 each at Spondon and Chellaston.

Somerset. Building programme for 1952 includes erection of a total of six schools and improvements to others.

Staffordshire. Building programme for next year includes £18,000 fire station at Uttoxeter.

Sutton and Cheam. Approval granted to Lunken Co., Ltd., for extensions to existing factory at 299 Ganda Green Lane, Sutton.

Tendring (Essex) R.D.C. Plans for 1952 approved providing for 36 dwellings at Gt. Bentley, 26 at St. Osyth, and 18 elsewhere.

Thedwastre (Suffolk R.D.C.) Erection of eight houses at Stowlangtoft. Council's Architect, Hunt and Coates, 84 Guildhall St., Bury St. Edmunds

Totnes (Devon) R.D.C. It is proposed to build 56 houses on seven sites.

Walsall T.C. Council recommended to proceed with second stage of new county technical college at Wisemore, costing £186,365.

Walthamstow. Approval granted to Crusader Manufacturing Co. for additions to their factory in Berwick Rd.

Watford T.C. Allocation of 200 houses has been received for first six months of next year.

Wath-upon-Dearne U.D.C. Construction of 52 houses in Campsall Field scheme. Engineer and Surveyor. Town Hall.

West Bromwich. Erection of works for McArthur and Co. Ltd. Architect and Surveyor is H. H. Clement, 33 Gt. Charles St., Birmingham.

West Hartlepool T.C. Application made for sanction to borrow £472,849 for erection of 366 houses. Plans being prepared for 422 houses on Aston Manor estate. Borough Architect is A. G. Sinclair. Council has approved a £110 scheme for installation of fluorescent lighting in part of Central Library.

West Riding. Erection of county primary school at Dalton and extensions to Maltby grammar school. Erection of Shipley Wrose county primary school. County Architect, "Bishopgarth," Westfield Rd., Wakefield. Standing Joint Committee recommended to approve a £250,000 programme for next year involving subdivisional headquarters at Shipley, Ripon and Wetherby, divisional headquarters at Otley and section station at Armthorpe.

West Sussex. Approval given for erection of school at Durrington.

Whitehaven. Approval received for first instalment of £85,000 local college.

OVERSEAS

India. Chohan Industries Ltd., 96 Chowringhee Sq., Calcutta, would like to obtain supplies of (among other items), motor car lamps, electrolytic copper wire and cables and Diesel engines.

MEETINGS TO NOTE

THURSDAY, DEC. 20

I.E.S. (Glos. and Cheltenham Centre).—"Light as an aid to Crime Detection." C. H. Edlin. Cadena Cafe, High St., Cheltenham, 6.15 p.m.

I.E.E. (Irish Branch).—"Electricity Tariffs and Rationing." Opened by Lt.-Col. Edgeworth. Trinity College, Dublin, 6 p.m.

A.S.E.E. (Luton Branch). "Maintenance of Factory Equipment." A. Carpenter. George Hotel, 8 p.m.

FRIDAY, DEC. 28

JNR. INSTN. OF ENGINEERS.—"Hydro-Electric Power Developments." J. Foster Petree. 39 Victoria St., S.W.1, 6.30 p.m.

WEDNESDAY, JAN. 2

I.E.E. (Tees-side sub-centre).—"Protection of Electrical Power Systems." H. Leyburn and C. H. W. Lackey. Cleveland Scientific and Tech. Inst., Middlesbro', 6.30 p.m.

THURSDAY, JAN. 3

I.E.S. (Nottingham Centre).—"Lighting of Modern Ocean Liners." T. Catten. E. Midlands Board, Smithy Row, 5.30 p.m.

I.E.S. (Exeter Group).—"Neon Lighting." C. Higgins. Providence Hall, Northernhay St., 7 p.m.

INCORP. PLANT ENGRS. (Peterboro' Branch).—"Power Distribution." G. J. Richardson. Gas Board, Church St., 7.30 p.m.

FRIDAY, JAN. 4

I.E.S. (Bath and Bristol Centre).—"Neon Lighting." C. Higgins. S.W.E.B., Old Bridge, Bath, 7 p.m.

I.E.S. (Birmingham Centre).—"Modern Transport Lighting." W. E. J. Drake. Imperial Hotel, 6 p.m.

I.E.S. (Huddersfield Group).—"Use and Misuse of Fluorescent Lighting." T. C. Holdsworth. Electricity Showroom, Market St., 7.15 p.m.

SATURDAY, JAN. 5

BIRMINGHAM ELECTRIC CLUB.—Children's Party at Grand Hotel, 3 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

J.E.M.P. Ltd., Alderman's House, Bishopsgate, E.C.2. Manufacturers of and dealers in electrical appliances, equipment, etc. Cap.: £1,000. Dirs.: C. Kean and B. Stern.

Plastic Aerials Ltd., Redhill Aerodrome, Redhill, Surrey. To carry out research development and other scientific work in connection with radio and radiolocation transmitting and receiving aerials, etc. Cap.: £100. Subs.: Gwendoline G. Ellston and Edith Sanders, 6 Austin Friars, E.C.2.

Radio-Electronic Engineering (Wembley) Ltd., 2a Parkfield Parade, South Harrow, Middx. Cap.: £1,000. Dirs.: R. M. Francis, Kathleen J. Francis and D. C. Willis.

Rowlands Controls Ltd., 1 Houghton St., Southport. Technical, scientific and economic consultants to the engineering, electronics, radio, television, chemical and plastic industries, etc. Cap.: £1,000. Dirs.: W. Rowland Reed and W. G. Beaver.

Seraph Sound Reproducers Ltd., Stenk Villa, Abbey Town, Cumberland. To take over from Donald S. Robson the benefit of British Letters Patent dated July 2, 1951, in relation to sound reproduction apparatus and of every extension thereof, and to trade as manufacturers of and dealers in sound recording and production appliances, etc, Cap.: £1,000. Dirs.: D. S. Robson and Mrs. A. M. Sherwood.

Stevenson and Falk Ltd. Manufacturers of and dealers in automatic and semi-automatic machines, gramophones, dictaphones, wireless receiving sets, etc. Cap.: £100. Permt. dirs.: H. G. R. Stevenson, 33, Greenford Gdns., Greenford, Mdx., and M. Falk, 62, Kingsley Grove, Reigate.

Walter Logan and Co. Ltd., 1 Kenton St., W.C.1. Importers and exporters of and dealers in electrical appliances, wireless and television sets and components, etc. Cap.: £500. Dirs.: W. Logan, Winifred A. Logan and D. Josephs.

Walters Refrigeration Service Ltd., Gt. Barr Railway Sidings, Birmingham 22A. Cap.: £2,500. Dirs.: D. V. Walters and Mrs. A. G. Walters.

William Storey and Partners Ltd., 391 Ewell Rd., Surbiton, Surrey. Plating engineers, radio, television, electrical, sound acoustic and general engineers, etc. Cap.: £100. Dirs.: T. W. Porter and W. A. Storey.

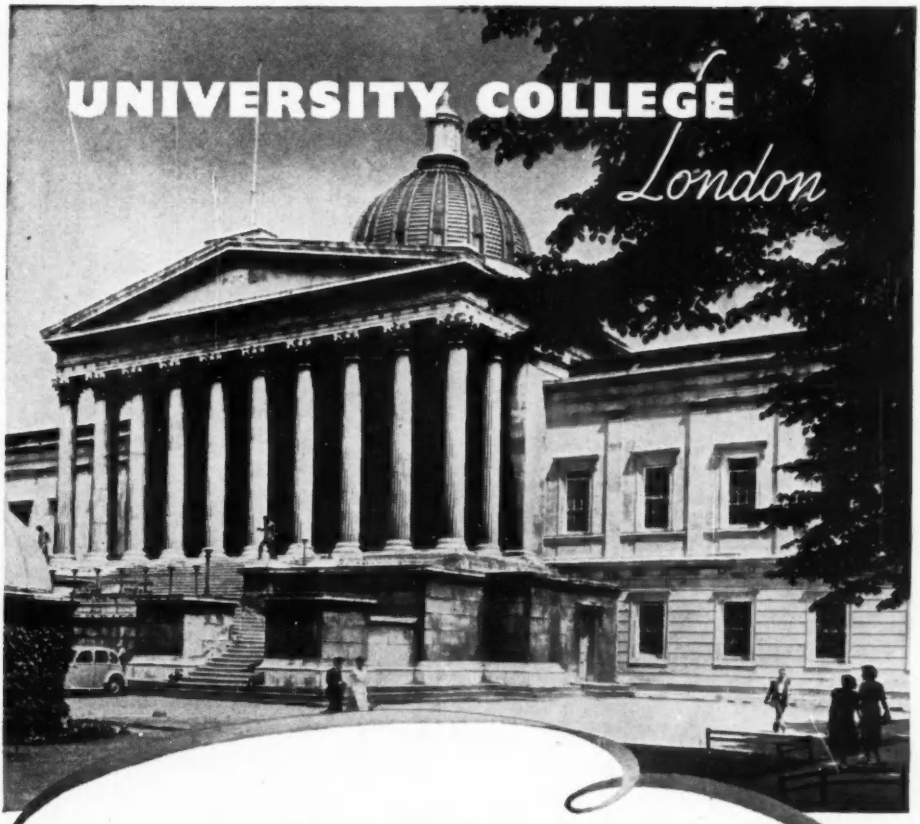
Absolon and Partners, Ltd., 23 Harcourt Hse, 19 Cavendish Sq., W.1. Mechanical, electrical and general engineers, etc. Cap.: £100. Dirs.: E. J. Absolon and Victoria C. Absolon.

Alton Projectors, Ltd., to take over from Reginald S. Alford the benefit of certain existing inventions relating to the projection of artificial light, etc. Cap.: £100. Dirs.: to be appointed by subs. Subs.: S. M. Hirsch, 79 Sinclair Rd., E.4, and N. Fidler, 30 Gunton Rd., E.5.

Charles Butterfield (Liverpool) Ltd. Marine, mechanical, motor, electrical and general engineers, ship repairers and builders, etc. Cap.: £1,000. Dirs.: C. S. Butterfield, Sobroan, Kingsfield Close, Woking, Surrey; and R. G. Butterfield.

Thermix Industries, Ltd. 6 Gt. Winchester St., E.C.2. To acquire from Airofiltre (Société Anonyme) a company incorporated in Switzerland, licences in respect of patents (when granted) relating to dust collectors for the removal of dust from air and gases, etc. Cap.: £10,000. Dirs.: to be appointed by subs. Subs.: W. Llewellyn-Roberts, R. J. Sherwood, and J. S. Drewett.

Cumbrian Electrical Co., Ltd., 12, Old Bush Lane, Lowther St., Carlisle. Dealers in electrical apparatus, etc. Cap.: £3,000. Dirs.: J. H. Speirs and Mrs. A. L. Speirs.



The building of University College London was begun in 1828 to the design of William Wilkins, R.A., architect also of the National Gallery and St. George's Hospital.

The Central Main Building suffered considerable damage during air raids in 1940 and Professor A. E. Richardson, R.A. is responsible for its reconstruction, the Consulting Engineers being Messrs. Barlow Leslie & Partners.

HENLEY CABLES are being used exclusively for the re-wiring by

RASHLEIGH PHIPPS & CO. LTD.

Thackeray St., Kensington Sq., W.8.

HENLEY CABLES

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, E.C.1

WESTON

Electrical Measuring Instruments

No. 7 Miniature Panel Instruments

The range of Weston panel instruments includes DC moving coil, AC rectifier and HF thermocouple types and instruments of the moving iron type. They are available in case diameters of 2", 2½" and 3½". Spring-loaded jewels protect the pivots from even the most severe shocks. Full details of these instruments will gladly be supplied on request together with information on the full Weston range, which includes switchboard, portable, sub-standard and laboratory standard instruments.

SANGAMO WESTON LIMITED

Enfield, Middlesex. Tel: Enfield 3434 (6 lines) & 1242 (4 lines). Grams: Sanwest, Enfield

Branches: Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. 0d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

HEPTON RURAL DISTRICT COUNCIL

STREET LIGHTING

TENDERS are invited for the supply and installation of 31 No. Lanterns, Lamps, Control Gear and Steel Standards for Group "A" Lighting on the Leeds-Halifax-Preston Trunk Road A646 at Charlestown, Hebden Bridge, Yorks, in the Rural District of Hepton.

Tenders are also invited for the supply of 11 No. Lanterns, Lamps, Control Gear and Brackets.

140-watt Sodium Discharge Lamps in enclosed-type lanterns are specified with a mounting height of 25 ft.

Drawings and conditions of contract may be inspected at the office of the surveyor to the council at District Bank Chambers, Hebden Bridge, from whom copies of the specification and form of tender may be obtained, on payment of a deposit of £2 2s, which will be refunded on receipt of a bona fide tender.

Tenders in plain sealed envelopes, endorsed "Sodium Lighting," should reach the undersigned not later than noon on Wednesday, January 9, 1952.

No undertaking is given to accept the lowest or any tender.

E. H. BLACKBURN,
Clerk to the Council.

District Bank Chambers, Hebden Bridge.
December 14, 1951. (P 414)

BOROUGH OF ACCRINGTON

DISPOSAL OF TIME SWITCHES

OFFERS ARE INVITED for the purchase of either the whole or part of the following mercury dash pot-type time switches:—

Name	*Type*	*No.*
Newbridge	J/1	7
Venner	C	27
Gunfire	—	24

Further details may be obtained from the Street Lighting Superintendent, Street Lighting Department, Taylor Street East, Accrington (Telephone No. 4150), where the switches may be inspected during normal working hours.

Tenders should be forwarded to me in sealed envelopes, marked "Tender for Time Switches," so as to be received not later than Monday, January 7, 1952.

JACK GARTSIDE,
Town Clerk.

Town Hall, Accrington.
December 13, 1951. (P 449)

CITY OF MANCHESTER

THE EDUCATION COMMITTEE invite tenders for the ELECTRICAL INSTALLATION at Crab Lane County Primary School, Blackley, Manchester.

Specification and drawings may be obtained at the office of the City Architect, Town Hall, upon payment of £1 1s., which sum will be returned upon receipt of bona fide tender. All cheques and postal orders are to be made payable to the order of "The Corporation of Manchester" and crossed.

Sealed tenders, enclosed in the official envelope, to be delivered at the Education Offices, Deansgate, Manchester 3, not later than 10 a.m. on Monday, February 11, 1952.

The Corporation do not bind themselves to accept the owest or any tender.

PHILIP B. DINGLE,
Town Clerk.

Town Hall,
Manchester.
December, 1951. (P 462)

APPOINTMENTS VACANT

METROPOLITAN WATER BOARD

APPOINTMENT OF ASSISTANT ELECTRICAL ENGINEERS

ASSISTANT Engineers (Electrical) required on permanent pensionable staff. Salary scale £655 to £810 per annum. Commencing salary according to age, qualifications and experience. Maximum age 45 years. It is a condition of the appointment to and the continued holding of these positions that the selected candidates shall be, and continue to be, subscribing members of the Institution of Electrical Engineers.

Applicants must have had responsible experience in the layout, specification, design and installation of electrical plant applicable to the pumping of water, including high tension sub-station design and installation, a.c. and d.c. motors and control gear, automatic systems, general lighting and telephones. The persons appointed will be required to advise on the economic purchase and operation of electrical plant.

Modern house available in good neighbourhood if required at inclusive rent of £125 per annum.

Particulars and a form of application may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, quoting reference (D).

W. S. CHEVALIER,
Clerk of the Board.

Offices of the Board,
New River Head,
Rosebery Avenue, London E.C.1. (P 375)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

JUNIOR ENGINEER

APPLICATIONS are invited for the above appointment in the Leek District of the North Staffordshire Sub-Area.

Duties will include general mains work, and surveys for overhead lines. Appropriate technical qualifications will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement and the salary will be Class "E", Grade 14, £413/£426 per annum.

Applications, giving details of age, qualifications and experience, should be forwarded within 14 days to: P. Thornton Wood, District Manager, Leek and Cheadle District, Midlands Electricity Board, Station Street, Leek, Staffs.

A. STEPHENS,
Secretary.

December 11, 1951. (P 445)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the position of ASSISTANT ENGINEER (Boiler House) at the Ribble Generating Station, Penwortham, Preston.

The salary range for this position, which is superannuable, will be £621/634/648 per annum, in accordance with Grade 10, Class "H," of the N.J.B. Agreement.

Candidates should preferably possess technical qualifications, and previous experience in the operation of boiler-house plant will be an advantage.

Although the successful applicant will spend the major part of his time in the boiler-house, he will have an excellent opportunity of obtaining experience in all branches of the operation of a modern high-pressure station.

Applications quoting Vacancy No. 640, and stating age, qualifications, present position, and giving full details of education and experience, should be received by the Establishments Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than December 29, 1951. (P 432)

CITY OF BULAWAYO

Electricity Department

(1) OVERHEAD MAINS ENGINEER
(2) UNDERGROUND MAINS ENGINEER
Gross commencing emoluments £1,145 per annum, plus Children's Allowances.

APPLICATIONS are invited for the above vacancies and they should be submitted in duplicate, one copy to reach the undersigned not later than January 9, 1952, and the other to Messrs. Merz and McLellan of Carliol House, Newcastle-upon-Tyne. Each application should contain full personal and professional details, and in the case of the copy submitted to the undersigned should be accompanied by an unmounted passport type photograph.

The commencing emolument will be in each case £1,014 10s. rising by annual increments of £39 17s. 6d. to £1,174, plus a standby allowance of £2 per month, children's allowances if applicable, and a transport allowance amounting to £10 18s. 5d. per month. This is based on a salary scale of £878 8s. rising by annual increments of £36 to £1,022 8s. plus a variable Cost of Living Allowance of £136 2s. at the commencement of the Grade and £151 1s. at the top.

Applicants for both these positions should preferably be Corporate Members of the Institution of Electrical Engineers, and have had general experience with a large electricity supply undertaking entailing a degree of responsibility that will enable the successful applicants to organise and control the respective sections in Bulawayo.

In Southern Rhodesia under existing conditions the successful applicant, if married and with two children, would not pay any income tax until the gross salary exceeds £1,120 per annum, excluding transport allowance.

The overhead mains engineer vacancy has already been advertised, but it is being re-advertised owing to certain changes having been made in the gross emolument applicable. Applicants for this vacancy should be capable of designing transmission and distribution lines both electrically and mechanically. They should be conversant with the ordering of materials for overhead electrical transmission schemes, competent to take charge of the erection of such schemes, familiar with schemes employing transmission voltages up to 66 kV and capable of carrying out switching operations together with modern methods of fault localisation and rectification.

Applicants for the underground mains engineer vacancy should have a thorough knowledge and experience of modern heavy switchgear practice, supertension cables, and modern protective practice. They should be familiar with schemes employing transmission voltages up to 33kV.

The children's allowance applicable to all vacancies is £30 per annum for the first child and £24 per annum for each of the next two children.

The successful applicants, if under the age of 50 years after serving a satisfactory probationary period of twelve months, will be required to join the pension fund on obtaining a satisfactory certificate from the Council's Medical Officer of Health.

The appointments will be subject to the Council's service, leave and sick leave regulations. Further details, if required, are available on application to Messrs. Merz and McLellan, Carliol House, Newcastle-upon-Tyne.

H. J. COOK,
Town Clerk.

P.O. Box 591,
Bulawayo,
Southern Rhodesia.
November 26, 1951. (P 311)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the following superannuable positions:—

Vacancy No. 642. OPERATION ENGINEER. Burnley Generating Station.

The salary for the position will be £655/£680 p.a., in accordance with Grade 5, Class "C," of the N.J.B. Agreement.

Candidates should preferably possess technical qualifications, and previous experience in the operation of a generating station is essential.

Vacancy No. 643. INSTRUMENT ENGINEER. No. 3 Sub-Division, located at Stuart Street Generating Station, Bradford, Manchester.

The salary for the position will be within the range of £629/£834 p.a., in accordance with Grade 5, Classes "AX/DX" of Schedule "C" of the N.J.B. Agreement.

The successful applicant will be responsible for the organisation within the group of stations comprising No. 3 Sub-Division, for the efficient maintenance of all types of instruments associated with boilers and turbines other than purely electrical instruments. In particular, candidates must have had considerable experience in the operation and maintenance of automatic boiler control systems, and possession of a Higher National Certificate in Electrical or Mechanical Engineering or an equivalent qualification, will be considered an advantage.

Applications, quoting vacancy number, stating age, qualifications, present position, and giving full details of education and experience, should be received by the Establishments Officer, British Electricity House, 825, Wilmslow Road, Manchester 20, not later than December 31, 1951. (P 455)

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the following superannuable positions:—

Vacancy No. 637. STATION SHIFT CONTROL ENGINEER, Burnley Generating Station.

The salary for this position will be £482/492/501 per annum, in accordance with Grade 10, Class "C" of the N.J.B. Agreement.

Candidates should have had previous experience in a modern generating station, and possess suitable technical qualifications.

Vacancy No. 638. BOILER HOUSE SUPERINTENDENT, Kearsley Generating Station.

The salary for this position will be £911/931/952 per annum, in accordance with Grade 6, Class "K" of the N.J.B. Agreement.

Candidates should possess technical qualifications, and must be thoroughly experienced in all phases of boiler-house operation.

Applications, quoting vacancy number, and stating age, qualifications and present position, and giving full details of education and experience, should be received by the Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, not later than December 29, 1951. (P 433)

MIDLANDS ELECTRICITY BOARD

Worcester and District Sub-Area

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER

APPLICATIONS are invited for the above position in the Banbury District of the Worcester Sub-Area. Conditions of service will be in accordance with N.J.B. Agreement and the salary will be Class 'D', Grade 7, £613 per annum.

Applicants should have had experience in all branches of Distribution work including the construction, operation, and maintenance of H.V. and L.V. networks, rotary convertor plant, substations, etc. Appropriate technical qualifications will be considered an advantage.

The successful candidate will be required to undertake standby duties.

Applications, giving age, full details of experience and qualifications, should be forwarded to: Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.

December 11, 1951. (P 444)

MIDLANDS ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER—PLANNING

APPLICATIONS are invited for the above appointment on the Chief Engineer's Staff at the Headquarters of the Midlands Electricity Board, Mucklow Hill, Halesowen, concerned with the Technical Investigations and Calculations associated with the Planning of Transmission and Distribution Systems.

Applicants should have received thorough training in the Electricity Supply Industry and should have experience in the Planning and Operation of H.V. and L.V. Distribution Systems. Appropriate technical qualifications will be considered an advantage.

The conditions of service will be in accordance with the National Joint Board Agreement, and the salary will be within Schedule "C" Class AX, Grade 5, £629/£765 per annum, according to qualifications and experience, and subject to an ultimate maximum in Class DX of £834 per annum.

Applications, stating age, experience, and qualifications should be made within 14 days to the Secretary (Ref. F.W.C.), Midlands Electricity Board, Mucklow Hill, Halesowen, near Birmingham.

A. STEPHENS,
Secretary.

December 10, 1951. (P 447)

MIDLANDS ELECTRICITY BOARD

Wolverhampton and District Sub-Area

APPOINTMENT OF THIRD ASSISTANT ENGINEER (ARCHITECTURAL)

APPLICATIONS are invited for the position of Third Assistant Engineer (Architectural) in the Engineering Section of the above Sub-Area.

Applicants should have considerable experience in the design and detailing of small industrial buildings. Membership of the R.I.B.A. will be considered an advantage.

Conditions of service will be in accordance with the National Joint Board Agreement, Class "J," Grade 10, £660/£685 p.a.

Applications, stating age, qualifications and previous experience, should be forwarded within 14 days to: F. J. Elliott, Esq., M.I.E.E., Sub-Area Manager, Midlands Electricity Board, 83 Darlington Street, Wolverhampton.

A. STEPHENS,
Secretary.

December 10, 1951. (P 458)

EASTERN GAS BOARD

Tottenham Division

APPLICATIONS are invited for the following appointments:—

POWER ENGINEER—Willoughby Lane Works

Candidates should be corporate members of the Institution of Electrical Engineers or hold an equivalent qualification.

The duties will mainly comprise:—

(a) Technical supervision of operation of steam and electric power plant.

(b) Supervision of electrical installation work, maintenance of electrical plant, including supervision of craftsmen.

Residence, adjoining the works, will be available in this case at a reasonable rental.

MECHANICAL ENGINEER—Divisional Office

Candidates should be corporate members of the Institution of Mechanical Engineers or hold an equivalent qualification.

The responsibilities cover the eight gas works of the Division and the duties will mainly comprise:—

(a) Supervision of all mechanical requirements under the Factories Acts, e.g. steam boilers and pressure vessels, gasholders, lifting appliances, etc.

(b) Safety precautions.

(c) Inspection of mechanical plant at makers' works and supervision of erection.

(The Works Engineers in each locality are responsible for mechanical maintenance.)

MECHANICAL ASSISTANT—Ponders End Works

Candidates should be corporate members of the Institution of Mechanical Engineers or hold an equivalent qualification.

The candidate appointed will be one of the two main technical assistants of the Works Engineer, the other being the Production Assistant. He will be responsible for mechanical and structural maintenance and must be capable of organising this work on a planned basis.

Candidates should have experience in steam and diesel plant and in the supervision of craftsmen.

Candidates for all the above posts should be between 27 and 45 years of age. The successful candidates will be required to pass a medical examination and to join such contributory superannuation scheme as the Board may adopt.

All the above appointments will be made within the Grade A.P.T. 11 (Metropolitan), £675 to £800 per annum, of the National Salary Scales for Gas Staffs.

Applications, stating age, qualifications, and experience, should reach the Personnel Officer, Woodall House, 658 Lordship Lane, London N.22, not later than January 1, 1952. (P 377)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

ASSISTANT ENGINEERS (Instruments) at Littlebrook Power Station. Applicants should preferably have Higher National Certificate or similar qualification and must be experienced in the maintenance, testing and calibration of all types of power station instruments. A knowledge of electronics would be an advantage. N.J.B. conditions of service and salary Class "J," Grade 12, £604/16/- p.a., including 5% London Allowance.

Applications on forms obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower-Ham Road, Kingstone-on-Thames, to be received not later than January 8, 1952. (P 459)

MIDLANDS ELECTRICITY BOARD

Shropshire and Herefordshire Sub Area

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER

APPLICATIONS are invited for the above position in the Wellington District of the Shropshire and Herefordshire Sub-Area.

Applicants must have had experience in all branches of distribution work including erection, operation and maintenance of high and low voltage cables, overhead and underground mains, substations, etc. Appropriate technical qualifications will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement and the salary will be Class "E," Grade 7, £629/£660 p.a.

Applications, stating age, present salary, full particulars of qualifications, experience, and present position, should be forwarded within 14 days to Mr. W. Winwood, Manager, Shropshire and Herefordshire Sub-Area, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary.

December 10, 1951. (P 460)

ELECTRICITY SUPPLY COMMISSION

Southern Rhodesia

VACANCY : TEST ASSISTANT

APPLICATIONS are invited for the above vacancy which exists at the Commission's Test Department, Salisbury.

Technical qualifications : Graduate I.E.E. or equivalent. Approximately 12 years' general experience in electrical testing is required. This period does not include apprenticeship which should preferably have been served in the testing department of a large overseas electrical engineering works.

Specific experience required is as follows :—

(1) To be fully conversant with the testing, dry-out and inspection of all types of power and distribution transformers, including on load tap changing units.
(2) Induction line voltage regulating equipment.
(3) Switchgear of all types.
(4) Condensers.
(5) Alternators and associated equipment.
(6) A.C. and d.c. motors, including control equipment.
(7) Checking and testing h.t. metering cubicles, switchboards and control panels manufactured and assembled at the Commission's workshops.
(8) General knowledge of instruments, meters and associated equipment. Instrument and meter secondary circuits.
(9) All test work involved in commissioning e.h.t. substation equipment, including transmission lines.
(10) The successful applicant would be required to supervise and direct staff placed under his control at any time.

Applicants should be, preferably, within the 30-35 years age group. Age limitation may, however, be waived in the event of the applicant's experience and qualifications being suited to the Commission's requirements. Salary scale : £766 10s. by £31 10s. to £861 per annum.

The general conditions of service include a contributory Provident Fund, Medical Aid Society, Holiday Fund, 45 days full-pay leave per annum, paid sick leave, child and dependant allowances where applicable. In addition to basic salaries at present a cost-of-living allowance of approximately 38% applies. Appointment will be subject to satisfactory medical examination and three months' probationary period.

Applications, giving age, educational and technical training and subsequent experience in chronological order, nationality, marital state with number and age of dependants, and enclosing copies of testimonials (which will not be returned) should be addressed to the Secretary, Electricity Supply Commission, P.O. Box 377, Salisbury, Southern Rhodesia, so as to arrive not later than January 21, 1952. (P 374)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

STATION SUPERINTENDENT
Leicester Generating Station

APPLICATIONS are invited for the post of Station Superintendent at Freeman's Meadow Generating Station, Leicester.

In addition to having served a recognised engineering apprenticeship, applicants must have had a wide experience of the operation, maintenance and administration of a large modern generating station, and should preferably be corporate members of a recognised professional institution or hold equivalent qualifications.

The salary will be in accordance with Class "H," Grade 1 of Schedule A of the National Joint Board Agreement.

The appointment is subject to the provisions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than December 28, 1951.

ASSISTANT ENGINEER (INSTRUMENTS)

Applications are invited from suitably qualified engineers for the position of Assistant Engineer (Instruments) at the Staythorpe Generating Station.

The chosen candidate will be responsible for the efficient maintenance of all types of instruments associated with the boiler and turbine plant.

Preference will be given to applicants who hold the Higher National Certificate in Electrical or Mechanical Engineering or equivalent qualifications.

The salary will be in accordance with Class "J," Grade 10, of the National Joint Board Schedule and the appointment will be subject to superannuation under the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than January 7, 1952.

L. F. JEFFREY,
Divisional Controller.
(P 373)

NORTH WESTERN ELECTRICITY BOARD

No. 1 Sub-Area

GENERAL ASSISTANT ENGINEER (Assistant Installation Engineer (Contracts))—1C District, Manchester.

The duties will include the supervision of the contract wiring electricians and obtaining and estimating for new contract wiring business.

Sound technical training an advantage, and experience in supervision of installation of wiring and appliances in domestic, commercial and industrial premises essential.

Salary scale: £487/504 p.a. Grade F.12. N.J.B. conditions.

JUNIOR ENGINEERS
(Testing Assistants)

Applicants should have had experience of testing work associated with meters, instruments or protective equipment. Possession of the Ordinary National Certificate will be an advantage. Experience in manufacturers' works will be considered an additional recommendation.

Salary scale: £375/527 p.a. Grade M.21/17. N.J.B. conditions.

Applications for the above posts to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall Extension, Manchester 2, P.O. Box 493, by January 5, 1952.

No. 4 Sub-Area

THIRD ASSISTANT ENGINEER
(Domestic and Commercial Sales Assistant), Sub-Area Consumers' Engineer's Department, Preston.

Applicants should have a thorough knowledge of all aspects of rural development, agricultural shows and the sale of agricultural equipment.

Salary scale: £699/728 p.a. Grade K.10. N.J.B. Conditions.

SECOND ASSISTANT DISTRICT CONSUMERS' ENGINEER
(Sales Superintendent), 4D (S.W. Fylde) District, Blackpool.

Duties include negotiation of all classes of sales and load development, lecturing, exhibitions and demonstration work, records systems and supervision of staff. Technical education up to Higher National Certificate standard will be an advantage.

Salary scale: £677/696 p.a. Grade F.7. N.J.B. conditions.

SENIOR MAINS RECORDS ASSISTANTS
at Preston and Blackpool.

Applicants must be capable of taking dimensions on site and preparing maps and sketches. Previous experience in a drawing office and/or supervision of mains records staff will be an advantage.

Salary scale: £440 x £20—£500 p.a. N.J.C. conditions.

(a) THIRD ASSISTANT ENGINEER
(Operation and Maintenance)
(b) THIRD ASSISTANT ENGINEER
(Construction); Sub-Area Headquarters, Preston.

Applicants for post (a) should have had a wide experience in the operation and maintenance of large industrial and rural networks, including o.h. lines and u.g. cables at voltages up to 33 kV, and in high voltage testing and fault localising.

Applicants for post (b) should be experienced in the survey, construction and operation of large industrial and rural networks, including o.h. lines and u.g. cables at voltages up to 33 kV, and should be capable of estimating for and supervising the installation of switchgear and transformers.

Salary scale (both posts)—£699/713/728 p.a. Grade K.10 N.J.B. conditions.

Applications for the above posts to be sent to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40-41 Lune Street, Preston, by January 5, 1952.

(P 456)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

APPOINTMENT OF JUNIOR ENGINEER (OPERATIONS AND TECHNICAL).

APPLICATIONS are invited for the above position in the North Staffordshire Sub-Area.

The person appointed will be required to carry out commissioning of new switchgear, etc., and be responsible for the testing and maintenance of protective equipment. In addition, he will be required to supervise the maintenance of supervisory equipment and automatic telephone systems. Some knowledge of v.h.f. radio communications is desirable. Appropriate technical qualifications will be considered an advantage.

Conditions of Service will be in accordance with the National Joint Board Agreement, and the salary will be Class "J," Grade 14, £505 p.a.

Applications, stating age, experience and present position, should be forwarded within seven days to Mr. H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, 31, Kingsway, Stoke-on-Trent.

A. STEPHENS,
Secretary.

December 13, 1951. (P 461)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

APPOINTMENT OF THIRD ASSISTANT ENGINEER (ARCHITECTURAL)

APPLICATIONS are invited for the above position at the Sub-Area Headquarters, 31 Kingsway, Stoke-on-Trent.

Applicants should have received a recognised architectural training and should be experienced in the design and construction of industrial and commercial type building.

Conditions of service will be in accordance with the National Joint Board Agreement and the salary will be Class "J," Grade 10, £660/£685 p.a.

Applications, giving full details of age, experience and qualifications, should be forwarded within 14 days, to: Mr. H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, 31 Kingsway, Stoke-on-Trent.

A. STEPHENS,
Secretary.

December 13, 1951. (P 457)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the following superannuable appointment in the Construction Department at Divisional Headquarters.

THIRD ASSISTANT ENGINEER (ELECTRICAL). N.J.B. AX/CX Grade 5 (£629-810).

Applicants should possess the Higher National Certificate or equivalent, and have Works and Drawing Office experience, together with experience in the design and preparation of schemes for switchgear, electrical auxiliaries, main and multicore cable work, and lighting and heating of large Power Stations.

Application forms, obtainable from the Divisional Secretary at the address below, should be returned by January 3, 1952.

H. J. BENNETT,
Divisional Controller.

British Electricity Authority,
Cardiff (Pengam Moors) Airport,
Cardiff.

December 12, 1951. (P 446)

ADVERTISING DEPARTMENT of well-known electrical engineering company in Central London requires an ASSISTANT (25-35). Duties include collecting and editing data from engineering and commercial departments for catalogues and technical publications. Some knowledge of electric lamps and lighting equipment is desirable.—Write, giving details of experience and salary to Box No. 1307, Electrical Times. (P 435)

AN OPPORTUNITY occurs with a well-known company for suitable WOMEN to be trained as WASHING-MACHINE ADVISERS. Knowledge of household electrical appliances and domestic science preferred. Must be mobile. Vacancies in London and the Provinces.—Apply to Box No. 1267, Electrical Times. (P 323)

COMPANY manufacturing diesel electric locomotives invites applications for the following staff:—DESIGNER DRAUGHTSMEN AND DRAUGHTSMEN who are experienced in the electrical and mechanical design of d.c. control equipment. Good salaries paid to men with exceptional qualifications. Three years agreement and every facility to find suitable living accommodation will be given. Staff Assurance scheme and good working conditions. Applications from men with industrial control gear experience will also be considered. Offers only to first-class men.—Please apply, giving full details of training, experience, age, etc., to Box No. 1253, Electrical Times. (P 278)

DRAUGHTSMEN (one senior, one junior), ELECTRICAL. Age range, 24-48. Experienced l.t. control gear, plant layout, and diagrams. Must have sound recognised apprenticeship and possess Higher National Certificate or equal. Site within easy reach of Wolverhampton. Good pension scheme (compulsory), canteen facilities, five-day week. State age, present salary, give references and detail apprenticeship training.—Box No. 1259, Electrical Times. (P 299)

DRAWING AND TRACING, LTD., have vacancies for experienced SENIOR DRAUGHTSMEN and JUNIOR DETAIL DRAUGHTSMEN in their production drawing office, specialising in radio, electrical and mechanical engineering. 5-day week. Pension scheme. Good working conditions. Salary range £390-£533.—Write, stating age and experience, 456 Ewell Road, Surbiton, Surrey. (P 431)

ELECTRICIAN MATES required, conversant with usual duties. Copies of references must be enclosed with application.—Box No. 1271, Electrical Times. (P 327)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

ELECTRICIANS required, fully experienced with site maintenance, including lighting, heating, power, a.c. and d.c. supplies. Copies of reference must be enclosed with application.—Box No. 1269, Electrical Times. (P 326)

JUNIOR CONTRACTS ENGINEER required by manufacturers of Diesel-electric locomotives. Applicants should be between the ages of 22 and 30, with technical training to graduate I.E.E. or I. Mech. E. standard and preferably practical experience or an apprenticeship with manufacturers of Diesel-electric traction equipment. The post will involve the commercial and general technical aspects of Diesel-electric locomotive manufacture and it will be an advantage if applicants possess previous contracts experience of this nature. Excellent prospects for man with personality and ambition. — Applications in confidence to Box No. 1305, Electrical Times. (P 434)

KUWAIT OIL CO. require an ASSISTANT ELECTRICAL ENGINEER (DESIGN) for service in Kuwait. Must possess full electrical apprenticeship and higher National Certificate. Graduate members of I.E.E. will be given preference. Must have experience in mains design and planning up to 11,000 V. Planning of industrial layouts an advantage. Age 30-35. Salary starting £830 p.a. clear, plus generous allowances, pension scheme and kit allowance.—Write, giving personal details and quoting K.1391, to Box D/80, at 191 Gresham House, E.C.2. (P 315)

KUWAIT OIL CO. invites applications for the post of ASSISTANT ELECTRICAL ENGINEER (INSTALLATION) in Kuwait. Required for installation of high-voltage switchgear and plant up to 11,000 V and motors up to 500 h.p.; also the checking of complex protective relays. Mechanical experience an advantage. Must possess Higher National Certificate, but preference given to corporate members of I.E.E. Age 30 to 35. Salary starting £830 per annum, plus generous allowances, kit allowance and pension scheme.—Write, giving personal details and quoting K.1386, to Box D/61, at 191 Gresham House, E.C.2. (P 314)

KUWAIT OIL COMPANY requires ELECTRICAL INSTRUMENT ENGINEER for overseas service in the Persian Gulf. Full apprenticeship with reputable instrument manufacturer essential and experience in manufacture and supervising of all types of electrical meters and instruments, including protective relays, automatic voltage regulators, etc. Higher National Certificate essential. Age under 35. Salary starting £830 p.a. clear, plus generous living allowance. Kit allowance; pension scheme. Write, giving details and quoting K.1159 to Box E/80, at 191, Gresham House, E.C.2. (P 453)

METER READER AND CLERK required, conversant with usual duties. Copies of references must be enclosed with application.—Box No. 1273, Electrical Times. (P 328)

SALES MANAGER required by large, long-established engineering company. Must have first-class technical knowledge, preferably with university degree in electrical engineering. Extensive experience of electronics essential. Position offers wide scope for really live man possessing initiative and sales ability of high order.—Write, giving full details of age, education and positions held, to Box E.T. 609, at 191 Gresham House, E.C.2. (P 316)

TRACTION MOTOR DRAUGHTSMEN AND DESIGNER DRAUGHTSMEN required by manufacturers of Diesel electric locomotives. A sound knowledge of the mechanical as well as the electrical design of traction motors is essential and applicants should have a wide experience of modern design and production methods in this class of work. Good salaries will be paid to men having these qualifications and special consideration will be given to other problems connected with the engagement of senior staff. Three years' agreement and every facility to find suitable living accommodations will be given. Please apply, giving full details of training, experience, age, etc., to Box No. 1311, Electrical Times. (P 451)

UNIVERSITY COLLEGE, SOUTHAMPTON, Department of Engineering. Applications are invited for the posts of SENIOR LECTURER and LECTURER OR ASSISTANT LECTURER in Electrical Engineering. Salary scales—Senior Lecturer £1,100 x £50—£1,400; Lecturer £500 x £50—£1,100; Assistant Lecturer £400 x £50—£500, plus superannuation and children's allowance. Further particulars and details of application can be obtained from the Secretary and Registrar, University College, Southampton. (P 452)

APPOINTMENTS WANTED

ELECTRICAL ENGINEER, translator, seeks post. Spanish or Portuguese.—Box No. 1295, Electrical Times. (P 420)

ELEC. ENGR. (Foreign Grad), knowing French, Spanish, Portuguese, German, English, desires position. Preferably as Commercial Engineer here or abroad.—Box No. 1293, Electrical Times. (P 419)

PERMANENT progressive position required by ELECTRICIAN-WIREMAN (27). Southern England preferred. All letters answered.—Box No. 1255, Electrical Times. (P 291)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed. Edgware 8631 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ALL makes of Portable Saws, Sanders, and Planers rewound, repaired, and electro-dynamically balanced. Prompt high-quality service.—Gilbert Electrical Tool Services, Ltd., 4 Clarence Street, Nottingham (Tel. 42890). (P 443)

CASTINGS. Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (L 318)

ENQUIRIES invited for repetition ARMATURE AND STATOR WINDING. Prompt delivery offered.—Magstarlite, Ltd., Beavor Works, Beavor Lane, Hammersmith, London, W.6. (P 411)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (A 20)

A 300 KVA ALTERNATOR, 400/3/50 V, at 375 r.p.m.—Lewis Electric Motors, Moor Works, Maidenhead 2388. (P 384)

BEST prices and a square deal offered in cash for ALUMINIUM, BRASS AND COPPER in sheets or rods. Works clearances and scrap a speciality.—Dyas and Fowle, 41 Loudoun Road, London N.W.8. Maida Vale 5477, 8641 and 5489. (N 61)

DIESELS, GENERATING SETS, Machine tools, etc., bought and sold on behalf clients. Inspections by qualified engineers.—Bramhall Engineering Co., Ltd. Borough Chambers, St. Petersgate, Stockport. (P 383)

ENAMELLED COPPER WIRE, size ·0064 in. (37 ½G), in any quantities up to 500 lb.—Submit offers to Box No. 1309, Electrical Times. (P 439)

MERCURY, platinum points, wire scrap, etc., purchased for cash.—Tresha, 1 Wardrobe Place, Ludgate Hill, London, E.C.4. (Open Sats.) (P 407)

PLATING RECTIFIER UNIT, complete with mains transformer preferred. Input, 400 V, 3 phase, 50 c/s; output, 16/18 V, 1,500 amp.—Oldfield Engineering Co., Ltd., 96 East Ordsall Lane, Salford 5. (P 425)

SCRAP ACCUMULATOR PLATES and Sediment wanted, any quantities. Also Storage Batteries purchased and dismantled.—Phone or write, Elton Levy Co. Ltd., St. Ermin's (West Side), Caxton Street, London S.W.1. Tel.: WHItehall 9621/2/3. (A 3)

STEEL Sheets, Plates, Strip and Bars. Any quantity, immediate payment. Grades Sheared Metal Co., Ltd., Green Lane, Hounslow, Middlesex. Tel.: Feltham 3274. (P 262)

TWO SYNCHROSCOPES, for use with 275 kVA alternators. 400/3/50 V supply.—Lewis Electric Motors, Moor Works, Maidenhead. Tel. 2388. (P 362)

WANTED, ROTARY CONVERTORS, any size.—Universal, 221 City Road, London, E.C.1. (A 16)

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ONE 50-h.p. Variable Speed COMMUTATOR MOTOR, 1140/230 r.p.m., complete with control gear.—Box No. 1301, Electrical Times. (P 426)

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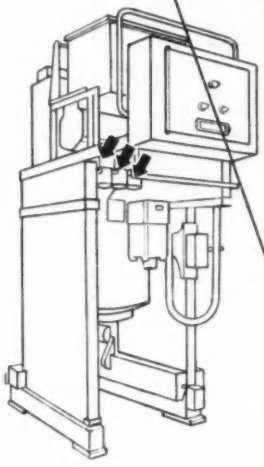

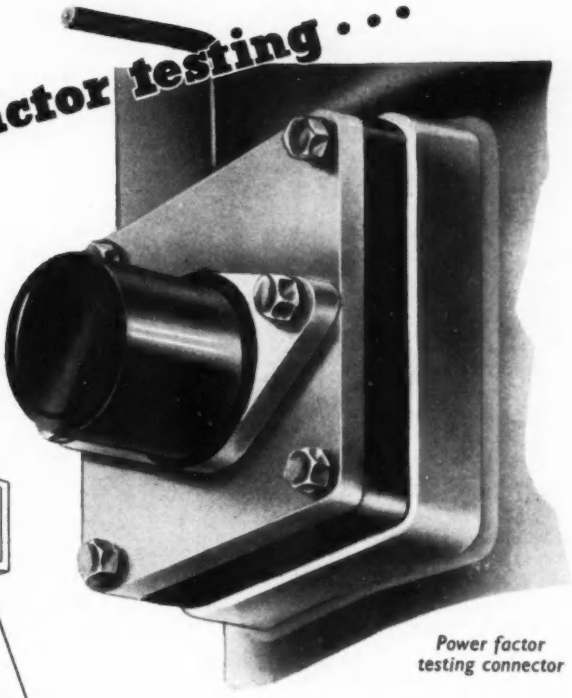

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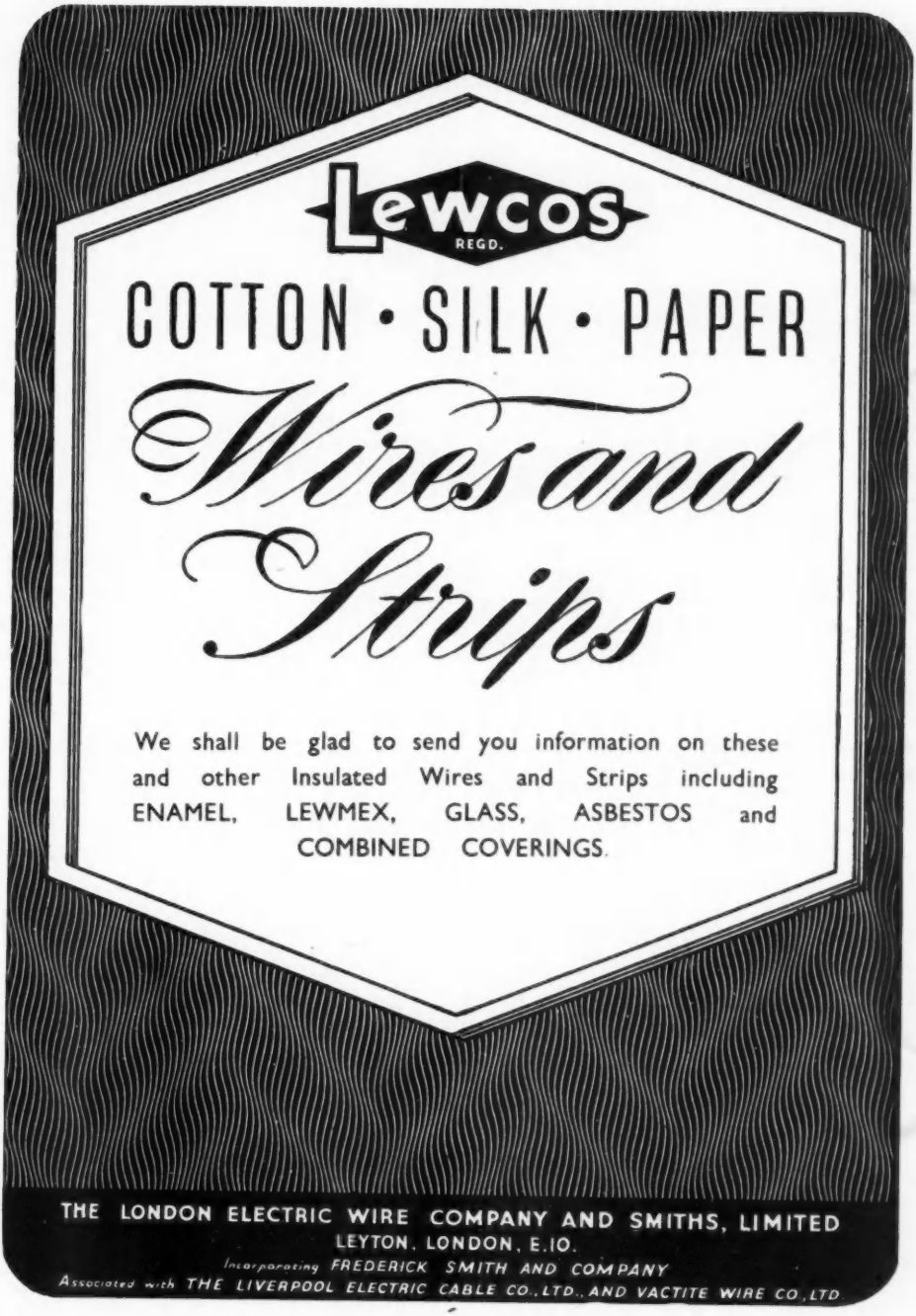
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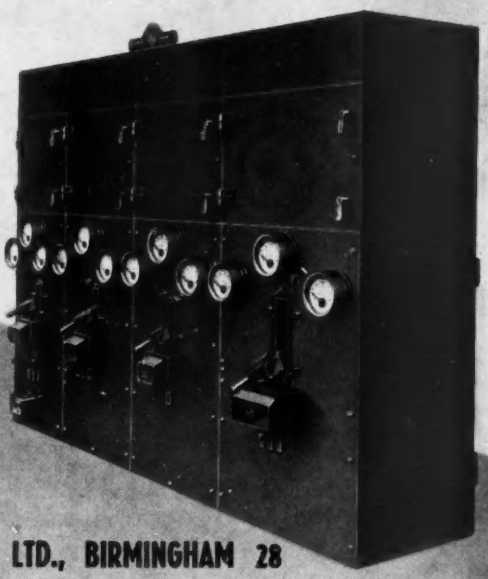

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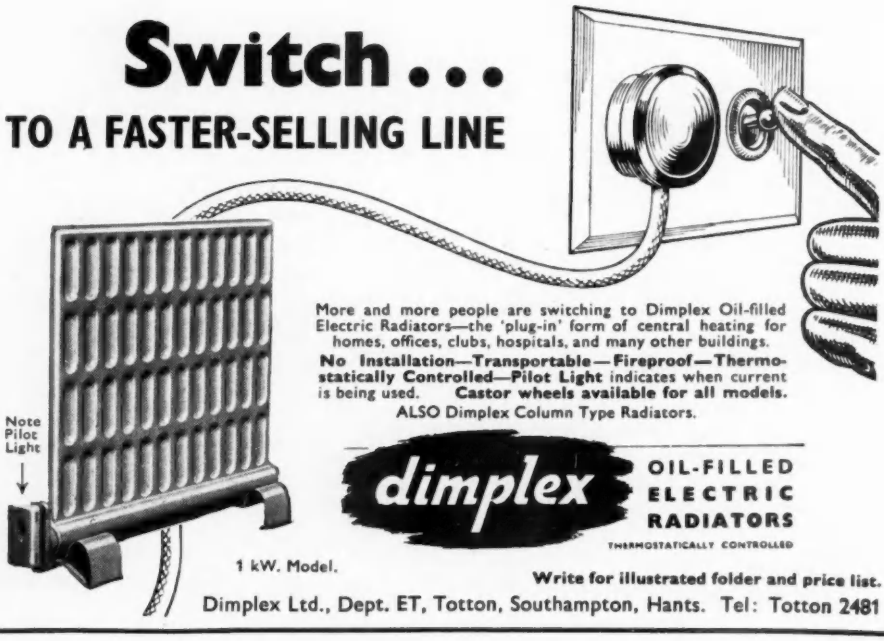

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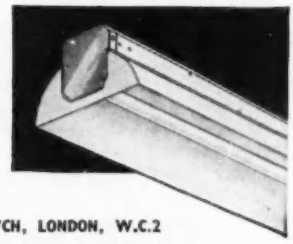

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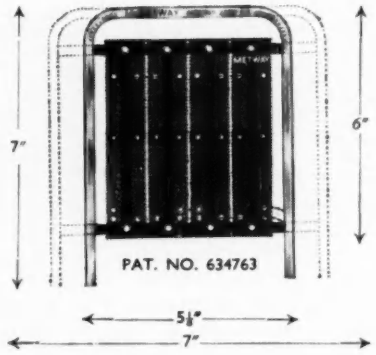

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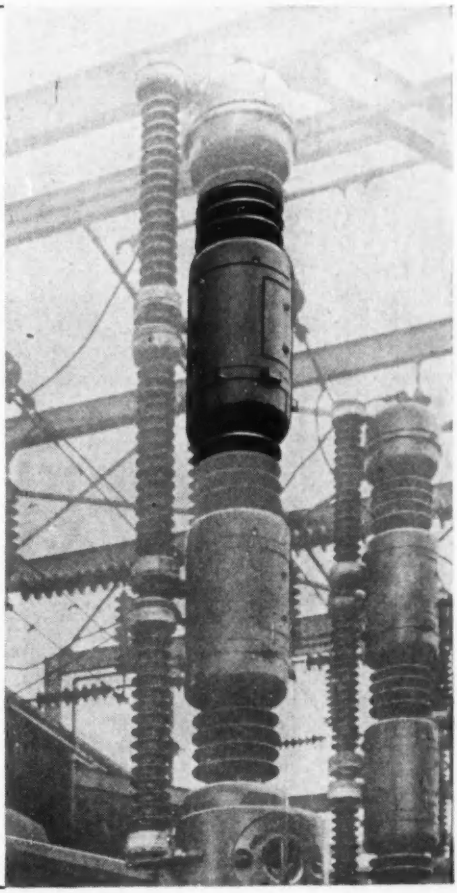

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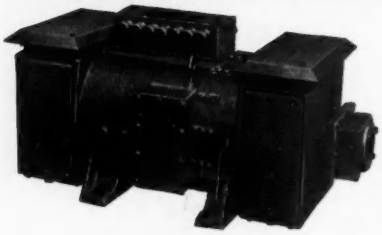

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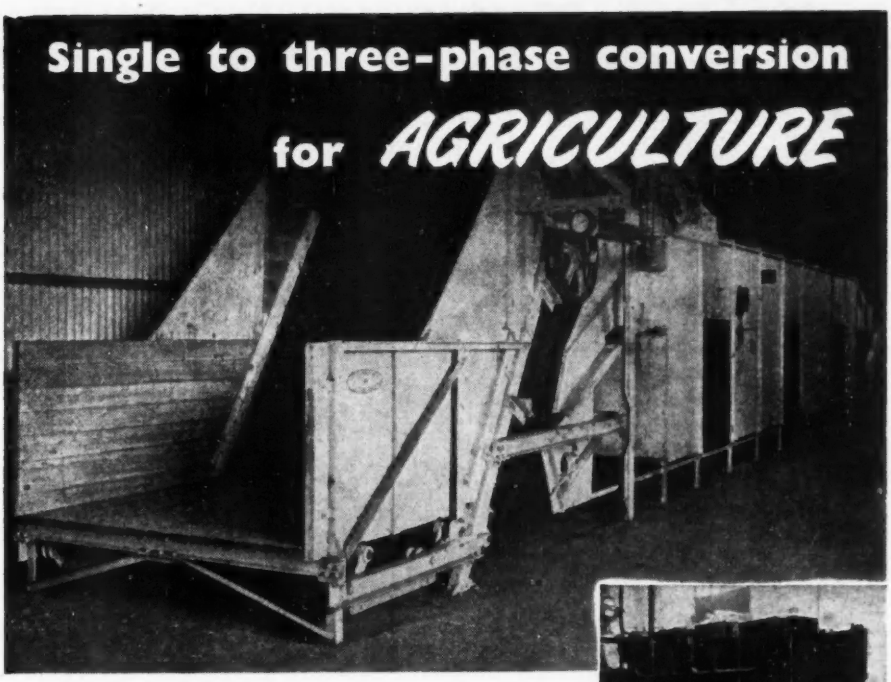

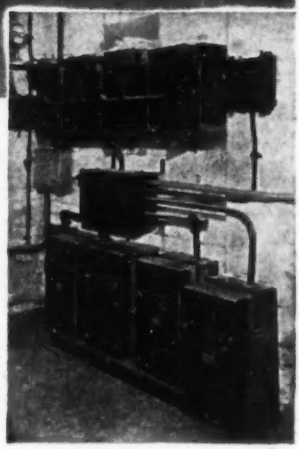

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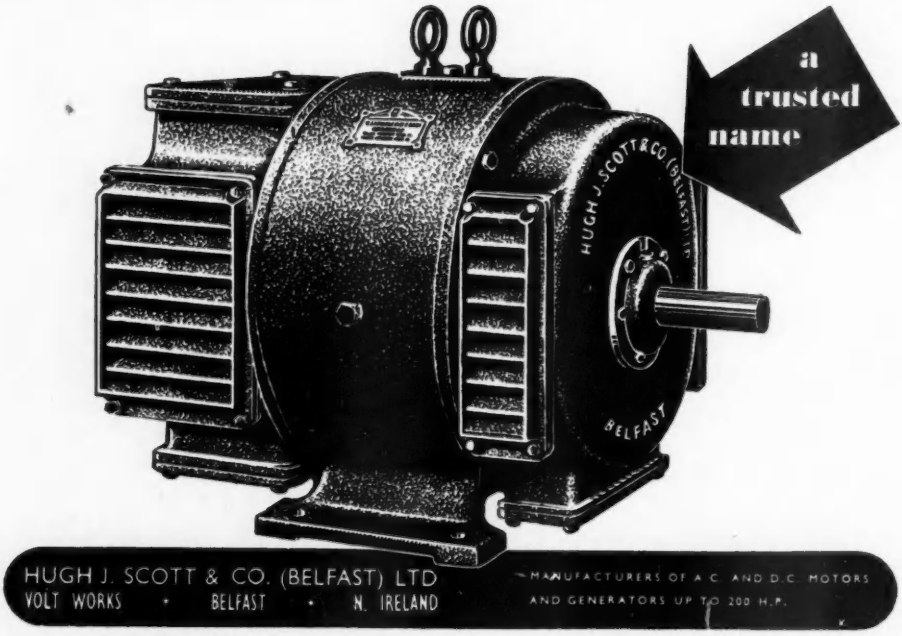
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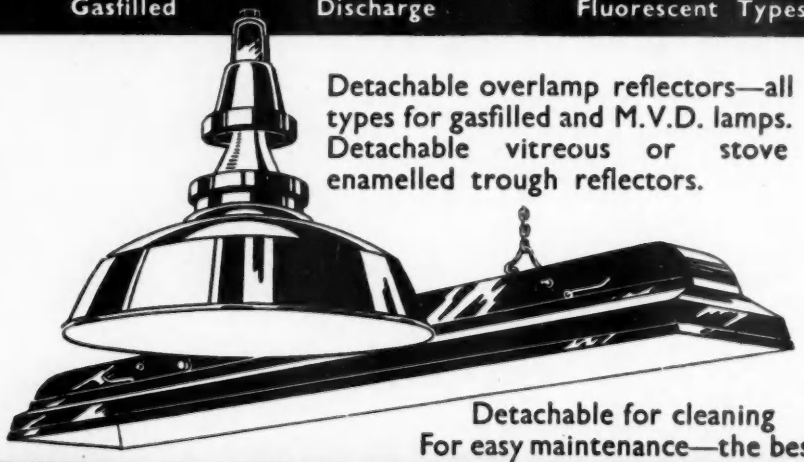

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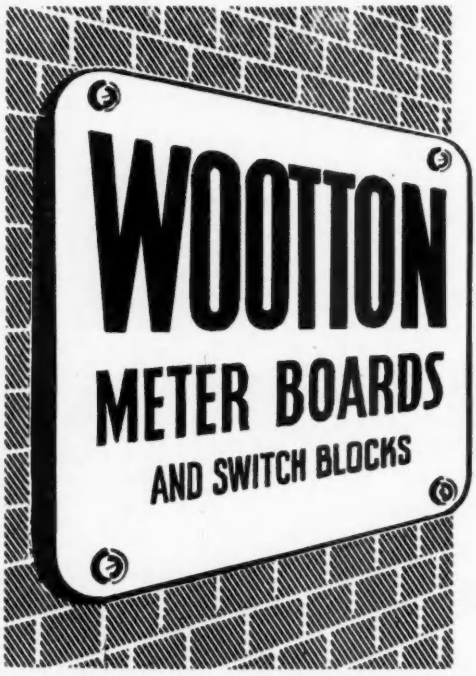

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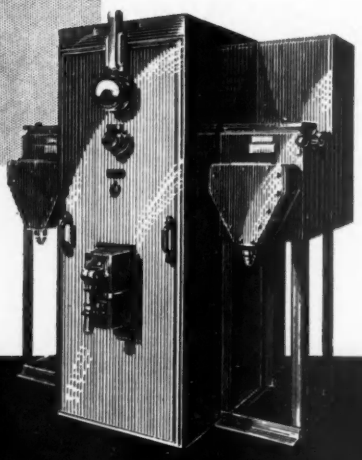

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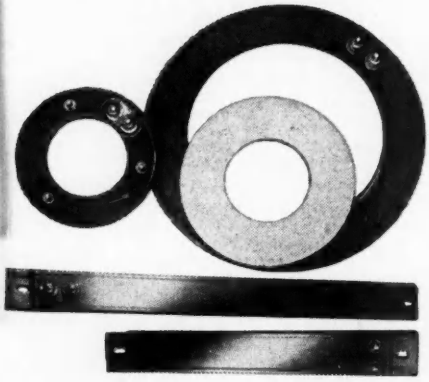

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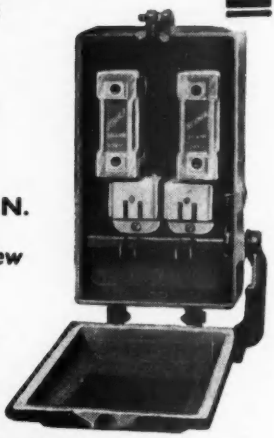

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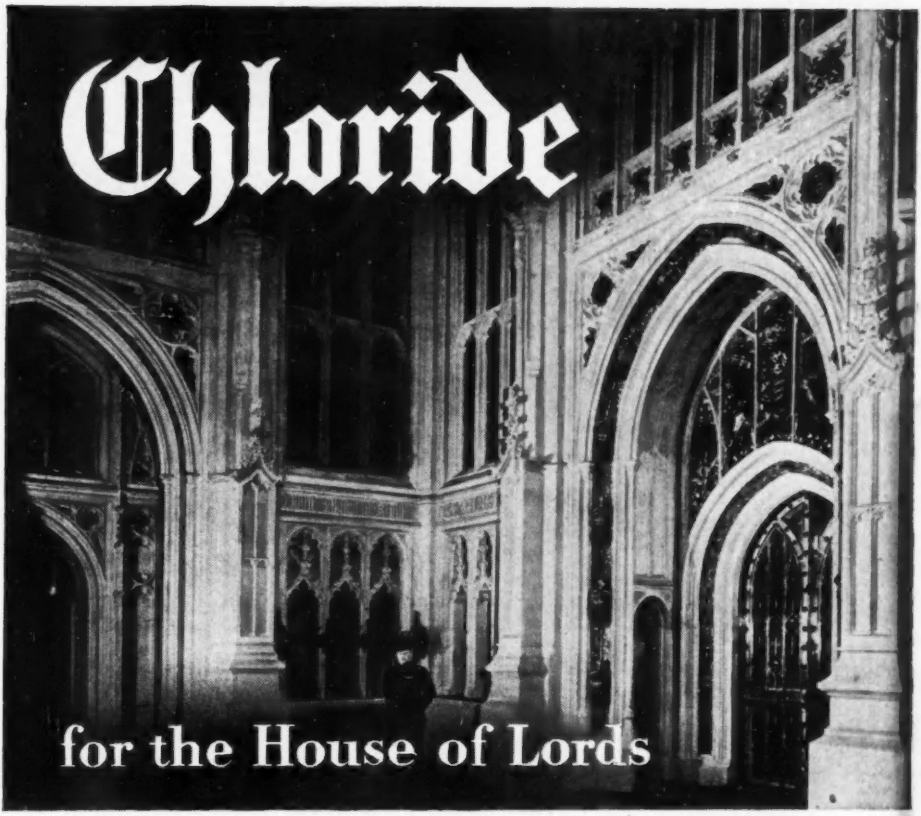

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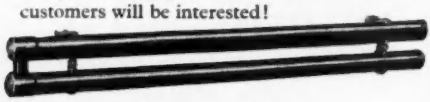

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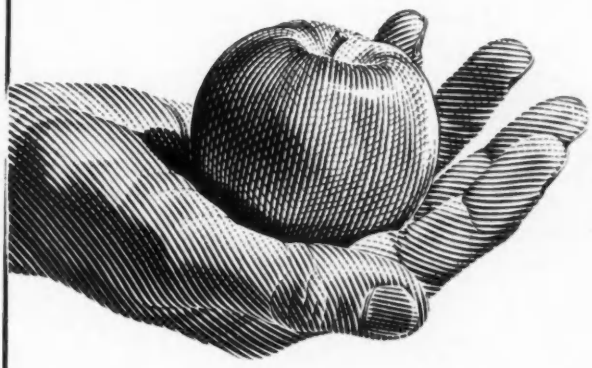

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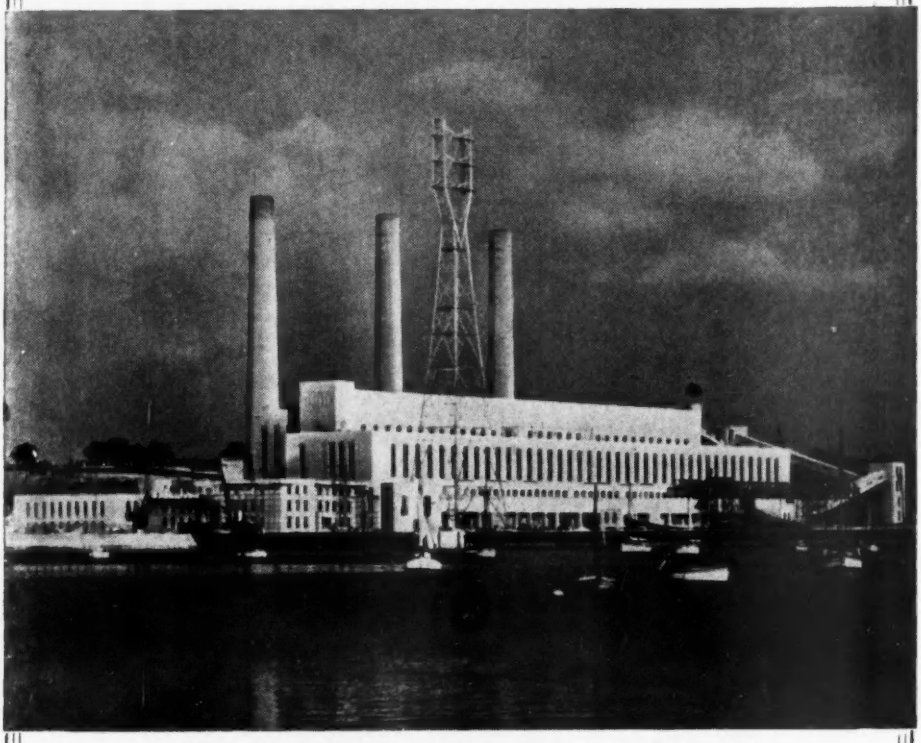

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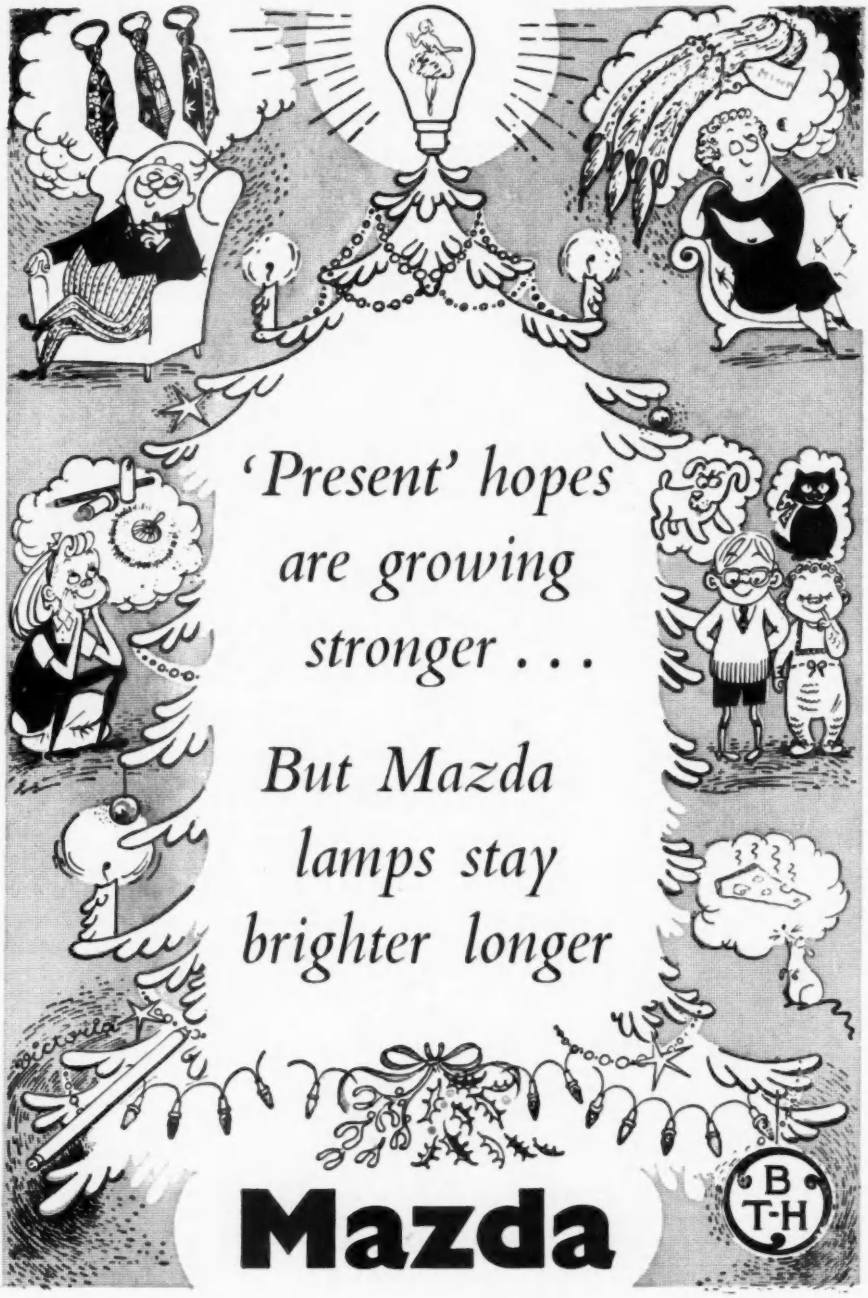
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